SCIENCE

2021

THE MAIN BOOK

BY A GROUP OF SUPERVISORS

FIRST TERM

Interactive Application
For Distance Learning

معاك
Ma3ak App

EL-MOASSER
SERIES

3rd prep.

CONTENTS

Force and Motion

Lessons of the unit :

1. Motion in One Direction.

2. Graphic Representation of Moving in a Straight Line.
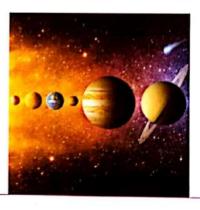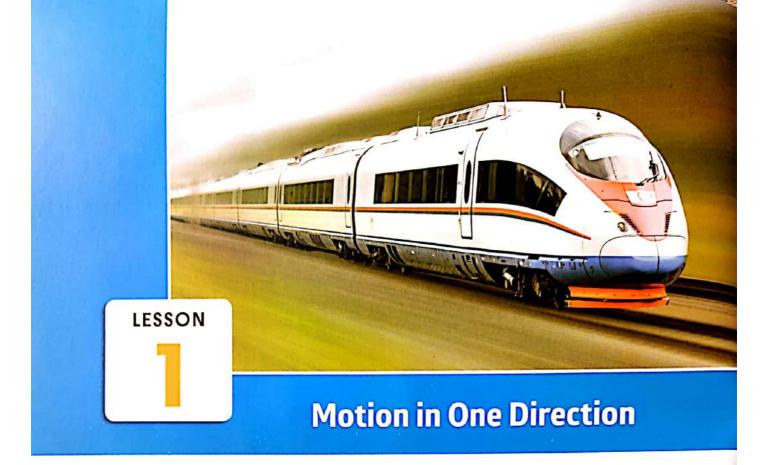
3. Physical Quantities ; Scalars and Vectors.

▶ Unit Objectives :

By the end of this unit, students will be able to :

- Describe motion and mention its types.

- Identify physical quantities necessary to describe the movement of objects.

- Link laws of motion to real life situations.

- Acquire mental skills in solving problems on laws of motion.

- Represent uniform speed graphically.

- Calculate the average speed of a moving object.

- Identify the concept of relative speed.

- Identify the concept of acceleration.

- Mention examples of some scalars and vectors as physical quantities.

LESSON 1

Motion in One Direction

What is meant by motion ?

- Motion happens all around us. Everyday, we see objects such as cars and motor bikes move in different directions at different speeds.
- When the position of an object (as a car) changes as time passes according to the position of another fixed object (as a tree), we can say that the first object (the car) is in a state of motion.

Motion

It is the change of an object position (location) as time passes according to the position of another fixed object.

- To simplify the concept of motion, we will study the **motion in one direction**, whether the path of a moving object : Straight or curved or combination of both.

- The simplest type of motion is : The motion in a straight line in one direction.

Example : The motion of the train or the Metro.

GR. *The motion of a train (or metro) is considered an example of motion in one direction.*

Because the train (or metro) moves forward or backward in a straight path or curved path or combination of both.

But, how can we describe and compare the motion of objects ?

Speed

- We can describe the motion of some objects around us as fast and some others as slow.

- Speed is a physical quantity which is used to describe and compare the motion of objects.

- If there are two cars, one of them is **Red** and the other is **Blue**, which of them is faster in the following two cases ?

The **first** case	The **second** case
If the two cars move for the same period of time which is 5 sec. • The Red car covers a distance of 100 m. • The Blue car covers a distance of 50 m.	**If the two cars cover the same distance which is 100 m.** • The Red car takes a time 5 sec. • The Blue car takes a time 10 sec.
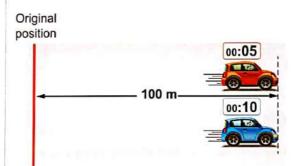
Original position

00:05

100 m

00:05

50 m

Original position

00:05

100 m

00:10

We find that

The Red car is faster than the Blue car GR. ?

Because it covers large distance (100 m.) in the same time (5 sec.).	Because it takes less time (5 sec.) to cover the same distance (100 m.).

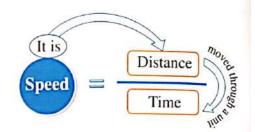### From the previous explanation, we conclude that :

The two factors necessary for the description of speed (motion) are :

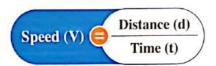| • The distance covered by the moving body.	• The time taken by the moving body to cover this distance.

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So, We can define speed as follows :

Speed

or It is the distance moved through a unit time.
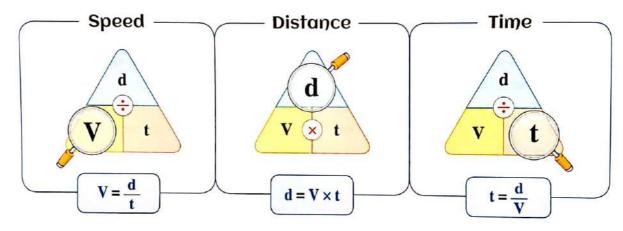It is the rate of change of distance.

It is Speed = $\dfrac{\text{Distance}}{\text{Time}}$ *moved through a unit*

⊙ **If an object covers a distance (d) in a time span (t) therefore , the object speed (V) can be expressed as follows :**

Speed (V) = $\dfrac{\text{Distance (d)}}{\text{Time (t)}}$

To calculate Speed , Distance and Time :

Speed

$$V = \dfrac{d}{t}$$

Distance

$$d = V \times t$$

Time

$$t = \dfrac{d}{V}$$

When the following happens ... ❓

The amount of the object speed is equal to the amount of the distance covered.

➲ When the object covers this distance through a unit time (1 hour or 1 minute or 1 second).

GR.

• *The object speed increases by decreasing the time taken to cover a certain distance.*

Because $V = d/t$, so the object speed is inversely proportional to the time taken, when the distance is fixed.

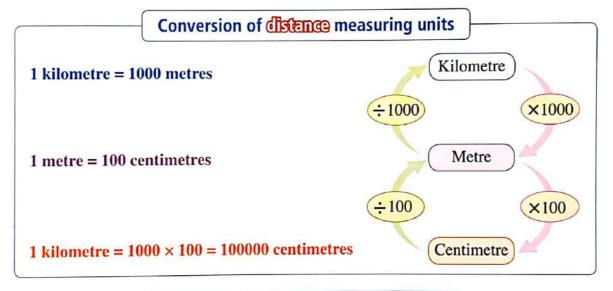• *The object speed increases by increasing the covered distance at a certain time.*

Because $V = d/t$, so the object speed is directly proportional to the covered distance, when the time is fixed.
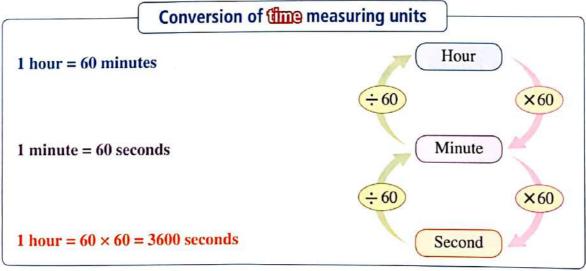
The measuring units of speed :

The speed measuring unit is different according to the units of distance and time which are used, as in the following table :

Measuring unit			Example
Distance	Time	Speed	
metre	second	m/sec.	The speed of cheetah = 27 m/sec.
metre	minute	m/min.	The speed of a bike = 30 m/min.
kilometre	hour	km/h.	The speed of a car = 100 km/h.
kilometre	second	km/sec.	The speed of light = 300000 km/sec.

Conversion of some measuring units :

Conversion of distance measuring units

1 kilometre = 1000 metres

1 metre = 100 centimetres

1 kilometre = 1000 × 100 = 100000 centimetres

Kilometre

÷1000   ×1000

Metre

÷100   ×100

Centimetre

Conversion of time measuring units

1 hour = 60 minutes

1 minute = 60 seconds

1 hour = 60 × 60 = 3600 seconds

Hour

÷60   ×60

Minute

÷60   ×60

Second

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Conversion of speed measuring units

$$\frac{1 \text{ kilometre}}{1 \text{ hour}} = \frac{1000 \text{ metres}}{60 \times 60 \text{ seconds}}$$

$$= \frac{10}{36} = \frac{5}{18} \text{ m/sec.}$$

km/h.

$\div \frac{5}{18}$

$\times \frac{5}{18}$

m/sec.

Ex.1 : A car moves at 72 km/h. $\longrightarrow$ $72 \times \frac{5}{18} = 20$ m/sec.

Ex.2 : A car moves at 20 m/sec. $\longrightarrow$ $20 \div \frac{5}{18} = 72$ km/h.

Problems

① *A runner runs at a speed of 6 m/sec. Find the distance covered by the runner in 10 seconds :*

Solution

$\because V = \dfrac{d}{t}$

$\therefore d = V \times t$ $\qquad d = 6 \times 10 = 60$ metres.

② *A train covers 50 metres in two seconds, find its speed in km/h.*

Solution

$V = \dfrac{d}{t} = \dfrac{50}{2} = 25$ m/sec. $\quad V = 25 \div \dfrac{5}{18} = 90$ km/h.

③ *A plane moves from Aswan airport and covers a distance of 850 km in 1 hour to reach Cairo airport. Calculate the speed at which the plane moves in :*

1. km/h. $\qquad\qquad$ 2. m/sec.

Solution

1. $V = \dfrac{d}{t} = \dfrac{850}{1} = 850$ km/h.

2. $V = 850 \times \dfrac{5}{18} = 236.1$ m/sec.

4 *A train starts to move at 6 o'clock in the morning, then what is the time of arrival if it moves at a speed of 40 km/h to cover a distance of 200 km ?*

Solution

$\because V = \dfrac{d}{t}$ $\qquad\qquad \therefore t = \dfrac{d}{V} = \dfrac{200}{40} = 5$ hours.

The time of arrival = 6 + 5 = 11

∴ The train arrival is eleven in the morning.

What is meant by ... ?

- **A car moves at a speed of 120 km/h.**
  - ➲ **This means that the car covers a distance of 120 kilometres in one hour.**

- **A train covers a distance of 150 km in two hours.**
  - ➲ **This means that the train moves at a speed equals 75 km/h.**

    Where, $V = \dfrac{d}{t} = \dfrac{150}{2} = 75$ **km/h.**

- **The speed of a car equals zero.**
  - ➲ **This means that the car is at rest.**

NB Cars and planes are usually provided with a group of counters such as speedometer, mileage, hour timer and compass.

EX. : If the car speedometer pointer points to 72, this means that the car speed is 72 km/h. (= 20 m/sec.).

GR. | *Cars and planes are provided by speedometer.*
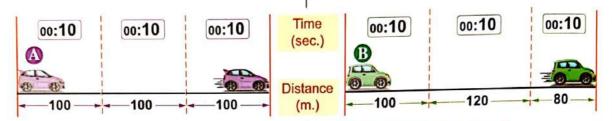To help us in identifying the speed of car and planes directly.

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Types of Speed

⊙ Speed can be described as :

| Regular (uniform) speed | **Or** | Irregular (non-uniform) speed |

What is the difference between them ?

From the previous two figures, we conclude that :

The car A

moves to cover equal distances (100 m.) at equal periods of time (10 sec.).

So, the car moves at a regular (uniform) speed.

Regular (uniform) speed

It is the speed by which the object moves when it covers **equal** distances at **equal** periods of time.

The car B

moves to cover unequal distances (100, 120, 80 m.) at equal periods of time (10 sec.).

So, the car moves at an irregular (non-uniform) speed.

Irregular (non-uniform) speed

It is the speed by which the object moves when it covers **unequal** distances at **equal** periods of time.

or

It is the speed by which the object moves when it covers **equal** distances at **unequal** periods of time.

What is meant by ... ?

An object moves at a regular speed of 50 km/h.

➲ This means that the object covers a distance of 50 kilometres each one hour.

GR.

• **Most of moving cars cannot move inside crowded towns all the time by uniform speed.**
Because the speed of the car changes according to the conditions of the road and the traffic.

• **The Metro moves at an irregular speed.**
Because the Metro covers unequal distances at equal periods of time or it covers equal distances at unequal periods of time.

Problems

(1) *Calculate the distance covered by a car which moves at a regular speed of 70 km/h during :*   1. Half an hour.   2. Two hours.

Solution

$$\because V = \frac{d}{t} \qquad\qquad \therefore d = V \times t$$

1. $d = 70 \times \frac{1}{2} = 35$ km.   **2.** $d = 70 \times 2 = 140$ km.

(2) *A body moves in a straight line at a regular speed and the distance covered in different times is recorded in the following table :*

Distance (m)	10	20	(X)	40	50	60
Time (sec.)	5	10	15	20	(Y)	30

1. Calculate the speed of the body.
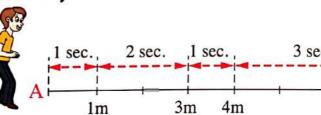
2. What is the value of (X) and (Y) ?

Solution

1. Speed $(V) = \dfrac{\text{Distance } (d)}{\text{Time } (t)} = \dfrac{10}{5} = \dfrac{20}{10} = \dfrac{40}{20} = \dfrac{60}{30} = 2$ m/sec.

2. • Distance $(X) =$ Speed $\times$ Time $= 2 \times 15 = 30$ m.

     • Time $(Y) = \dfrac{\text{Distance}}{\text{Speed}} = \dfrac{50}{2} = 25$ sec.

(3) *From the following figure, does the person move at a regular speed or at an irregular speed ? Why ?*

Solution

$$V_1 = \frac{d_1}{t_1} = \frac{1}{1} = 1 \text{ m/sec.} \qquad\qquad V_2 = \frac{d_2}{t_2} = \frac{3-1}{2} = 1 \text{ m/sec.}$$

$$V_3 = \frac{d_3}{t_3} = \frac{4-3}{1} = 1 \text{ m/sec.} \qquad\qquad V_4 = \frac{d_4}{t_4} = \frac{7-4}{3} = 1 \text{ m/sec.}$$

$$\therefore V_1 = V_2 = V_3 = V_4$$

So, the person moves at a regular (uniform) speed as he covers equal distances (1 metre) at equal periods (1 sec) of time.

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• Think

What is the thing that moves at a constant speed in the space ?

All electromagnetic waves such as light transfer through the space with a constant speed equals 3×10^8 m/sec.

For illustration

Science, Technology and Society

The time needed for the sunlight to reach the Earth is determined by the relation

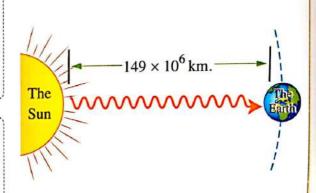speed of light $= \dfrac{\text{Distance}}{\text{Time}}$

By knowing
- The distance between the Earth and the Sun equals 149 million km (approximately).
- The regular speed of the light in the space equals 300 000 km/sec.

So,

The time needed for the sunlight to reach the Earth $(t) = \dfrac{d}{V} = \dfrac{149 \times 10^6}{300\,000} = 497$ sec.

$= 8$ minutes and 17 seconds.

The Sun ⟶ 149×10^6 km. ⟶ The Earth

i.e. If the time of sunrise is six o'clock. This means that the light travelled from the Sun at **five o'clock and fifty one minutes and 43 sec.**

$06:00:00$	$-$	$00:08:17$	$=$	$05:51:43$
(The time of sunrise)		(The time needed for the sunlight to reach the Earth)		(The time at which the sunlight travelled from the Sun)

Average Speed

TRY to answer worksheet **1** in the Notebook

✻ It is difficult to determine the amount of irregular speed of the object so, we use another term which is called "Average speed".

Average speed

It is the total distance covered by the moving object divided by the total time taken to cover this distance.

It is **Average speed** $= \dfrac{\text{Total distance covered}}{\text{Total time}}$ divided by

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⊙ **Average speed can be calculated as follows :**

Average speed ($\overline{V}$) = $\dfrac{\text{Total covered distances (d)}}{\text{Total periods of time (t)}}$

($\overline{V}$) = $\dfrac{d_1 + d_2 + d_3 + \ldots\ldots}{t_1 + t_2 + t_3 + \ldots\ldots}$

What is meant by ... ❓

The average speed of a moving car is 40 km/h.

➲ This means that the total covered distances (40 km) by the car through a total periods of time (one hour).

Problems

(1) *A racer covered a distance of 100 metres of a straight track in 10 seconds, then he returned back walking, he took 80 seconds to come back to the starting point of running.*
Calculate the racer's average speed :
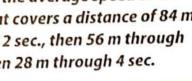1. While running.   2. While returning.
3. During the whole trip.

Solution

1. The racer's average speed while running ($\overline{V}$) = $\dfrac{d}{t}$ = $\dfrac{100}{10}$ = 10 m/sec.

2. The racer's average speed while returning ($\overline{V}$) = $\dfrac{d}{t}$ = $\dfrac{100}{80}$ = 1.25 m/sec.

3. The racer's average speed during the whole trip ($\overline{V}$) = $\dfrac{d_1 + d_2}{t_1 + t_2}$ = $\dfrac{100 + 100}{10 + 80}$ = $\dfrac{200}{90}$

= 2.2 m/sec.

(2) *A runner covered the first 100 metres of the race at 10 seconds and the last 300 metres of the race at 40 seconds. Find in which part of the race did he have the highest average speed ? Then , calculate the average speed during the whole trip.*

Solution

- The runner's average speed during the first 100 m ($\overline{V}$) = $\dfrac{d}{t}$ = $\dfrac{100}{10}$ = 10 m/sec.

- The runner's average speed during the last 300 m ($\overline{V}$) = $\dfrac{d}{t}$ = $\dfrac{300}{40}$ = 7.5 m/sec.

∴ The runner's average speed in the first 100 m was faster than that in the last 300 m.

- The runner's average speed during the whole trip ($\overline{V}$) = $\dfrac{d_1 + d_2}{t_1 + t_2}$ = $\dfrac{100 + 300}{10 + 40}$

= $\dfrac{400}{50}$ = 8 m/sec.

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3 *Calculate the average speed of an object that covers a distance of 84 m through 12 sec., then 56 m through 8 sec., then 28 m through 4 sec.*

Solution

$$\text{Average speed } (\overline{V}) = \frac{d_1 + d_2 + d_3}{t_1 + t_2 + t_3}$$

$$= \frac{84 + 56 + 28}{12 + 8 + 4}$$

$$= \frac{168}{24} = 7 \text{ m/sec.}$$

4 *Calculate the regular speed of an object that moves in a straight line to cover a distance of 168 m through 24 sec.*

Solution

$$\text{Regular speed } (V) = \frac{\text{Distance}}{\text{Time}}$$

$$= \frac{168}{24}$$

$$= 7 \text{ m/sec.}$$

⊙ From examples (3) & (4), we can define the average speed in other words as follows :

Average speed

It represents the regular speed by which the object moves to cover the same distance at the same period of time.

NB When a body moves at a regular speed, its average speed equals the regular speed (**i.e.** $\overline{V} = V$).

When the following happens ... ❓

- **The value of average speed of a moving body equals to its speed at any moment** $(\overline{V} = V)$.
  ➲ When the body moves at a regular speed.

- **The value of average speed of a moving body differs from the value of its speed at any moment** $(\overline{V} \neq V)$.
  ➲ When the body moves at an irregular motion (irregular speed).
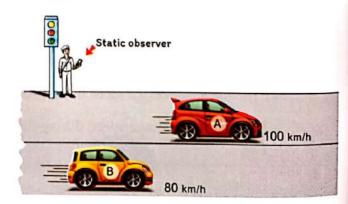
Relative Speed

✻ If there is a person standing on the side of the road (called the observer) to observe two cars (A & B), the car (A) moves at 100 km/h and car (B) moves at 80 km/h in the same direction.

Therefore :
- The speed of car (A) relative to the static observer = 100 km/h.

- The speed of car (B) relative to the observer = 80 km/h.

- The speed of car (A) relative to an observer in car (B) = 100 − 80
  = 20 km/h.

Static observer

A 100 km/h

B 80 km/h

Notes

- The speed of car (A) relative to the static observer differs from its speed relative to an observer in car (B).
- Measuring the relative speed depends on the position of the observer who determines the magnitude of this speed.

Relative speed

It is the speed of a moving object relative to a static or a moving observer.

⊙ **The relative speed of a moving object in a certain direction differs according to the observer state and the direction of its movement as shown in the following table :**

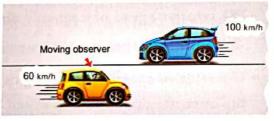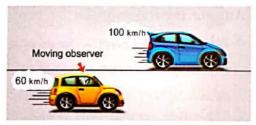| The observer state	Relative speed	Illustrating example
1 **The observer is at rest.**	The relative speed = The real (actual) speed of the object.	 The relative speed of the car = 100 km/h. **i.e.** "The relative speed is equal to the real speed".
2 **The observer is moving in the opposite direction of the moving object.**	The relative speed = The real speed of the object + The observer's speed. **So,** The real speed of the object = The relative speed of the object – The observer's speed.	 The relative speed of the car = 100 + 60 = 160 km/h. **i.e.** "The relative speed is more than the real speed".
3 **The observer is moving in the same direction at different speed.**	The relative speed = The real speed of the object – The observer's speed. **So,** The real speed of the object = The relative speed of the object + The observer's speed.	 The relative speed of the car = 100 – 60 = 40 km/h. **i.e.** "The relative speed is less than the real speed".

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| ④ The observer is moving in the same direction at the same speed. | The relative speed = The difference between the two speeds = Zero. | The relative speed of the car = 60 – 60 = Zero. **i.e.** "The object seems static". |

GR. *The moving car seems stable (at rest) to an observer moves at the same speed and the same direction.*

Because the relative speed equals the difference between their speeds equals zero.

What is meant by ... ?

• The relative speed of a moving car is 90 km/h.

➲ This means that the speed of the car relative to an observer equals 90 km/h.

• The relative speed of a moving object equals its real speed.

➲ This means that the observer is at rest.

• The relative speed of a moving car equals 70 km/h to an observer moves in the opposite direction at a speed 20 km/h.

➲ This means that the real speed of the car equals 50 km/h.

? Exercise

Answer the following :

❉ *When does the relative speed of a moving object relative to an observer equal to double of its real speed ?*

Answer

This occurs when the observer moves in the opposite direction at the same speed of the moving object.
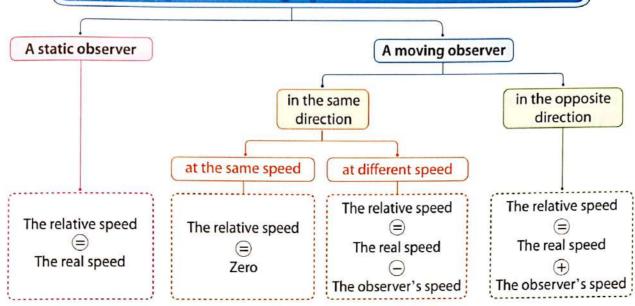
❉ *When does the relative speed of a moving object relative to an observer equal to zero ?*

Answer

This occurs when the observer moves in the same direction at the same speed of the moving object.

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✳ **We can summarize the previous explanation in the following diagram :**

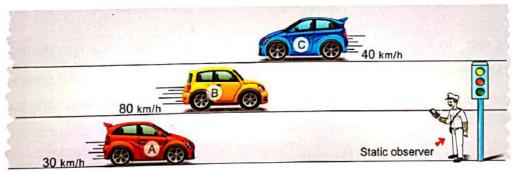The relative speed of a moving object in a certain direction is related to

| A static observer | A moving observer |

A moving observer
- in the same direction
- in the opposite direction

in the same direction
- at the same speed
- at different speed

A static observer

The relative speed
=
The real speed

at the same speed

The relative speed
=
Zero

at different speed

The relative speed
=
The real speed
−
The observer's speed

in the opposite direction

The relative speed
=
The real speed
+
The observer's speed

Problem

• **As shown in the following figure :**

Two cars move in the same direction, car (A) moves at speed of 30 km/h and car (B) moves at speed of 80 km/h, while car (C) moves in the opposite direction at speed of 40 km/h.
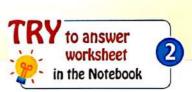
Calculate the relative speed of car (B) relative to an observer :

1. Stands on the ground.   2. In car (A).   3. In car (C).

C 40 km/h

B 80 km/h

A 30 km/h

Static observer

Answer

1. The relative speed of car (B) relative to an observer on the ground = 80 km/h.
2. The relative speed of car (B) relative to an observer in car (A) = 80 − 30 = 50 km/h.
3. The relative speed of car (B) relative to an observer in car (C) = 80 + 40 = 120 km/h.

TRY to answer worksheet **2** in the Notebook

Remember

○ Motion :

It is the change of an object position (location) as time passes according to the position of another fixed object.

- The path of a moving object may be **straight** or **curved** or **combination of both**.
- The simplest type of motion is : The motion in a **straight line in one direction.**

○ Speed :

It is the distance covered through a unit time. $\boxed{V = \dfrac{d}{t}}$

○ The two factors necessary for the description of motion (speed) are :

1. The distance covered by the moving body (the length of the path).

2. The time taken by the moving body to cover this distance.

○ Measuring units of speed :

- Metre/second (m/sec.)   - Kilometre/hour (km/h).

○ Regular (uniform) speed :

It is the speed by which the object moves when it covers equal distances at equal periods of time (whether the distance and time are short).

○ Irregular (non-uniform) speed :

It is the speed by which the object moves when it covers unequal distances at equal periods of time.

Or

It is the speed by which the object moves when it covers equal distances at unequal periods of time.

○ Average speed :

It is the total distance covered by the moving object divided by the total time taken to cover this distance.

Or

It represents the regular speed by which the object moves to cover the same distance at the same period of time.
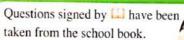
○ Relative speed :

It is the speed of a moving object relative to a constant or a moving observer.

○ The relative speed of a moving object depends on :

1. Observer's position (at rest or at a state of motion).

2. Observer's direction (in the same direction or in opposite direction).

3. Observer's speed.

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Questions

on lesson one

Interactive Exercises

1. Choose the correct answer :

1. The concept of the body movement means ....
   a. constancy of its position with the change in time.
   b. the change in its position with the time.
   c. its speed.
   d. its acceleration.   *(Aswan, North Sinai 2019)*

2. The two factors which can be used to describe the motion of a body are the ....
   a. speed and time.   b. distance and time.
   c. area and time.   d. displacement and speed.
                                          (Assiut, Damietta, New Valley 2020)

3. The distance covered by a moving body through a unit time is called the .... of the body.
   a. weight   b. density   c. speed   d. motion

4. Speed equals ....   *(Suez 2016 / Alexandria 2017)*
   a. distance ÷ time.   b. distance × time.   c. distance + time.   d. time ÷ distance.

5. 📖 Speed measurement unit is ....   *(South Sinai 2019 / Assiut 2020)*
   a. metre.second.   b. metre/second.   c. metre/second^2.   d. no correct answer.

6. A moving bus covers a distance of 500 m in 25 sec., so its speed equals ....
   a. 200 m/sec.   b. 20 m/sec^2.   c. 20 m/sec.   d. 20 m.   *(Sharkia 2013)*

7. If a car and a bike moving from the same position and in the same direction, the speed of the car is 50 m/sec. and the speed of the bike is 10 m/sec., after 4 seconds. The distance between them becomes .... metre.
   a. 100   b. 160   c. 200   d. 240

8. The opposite table represents the relation between distance and time of an object moves at a regular speed. The value of X equals .... cm.

Distance (cm)	90	X	180
Time (sec.)	4	6	8

   a. 130   b. 135   c. 140   d. 145

9. A train moves at a speed 100 km/h, then it covers a distance of 50 km within time .... hours.
   a. 0.3   b. 0.4   c. 0.5   d. 0.6   *(Minia 2020)*

10. When a moving object covers equal distances in equal periods of time, this means that the object moves at ....   *(Ismailia 2018 / Sohag 2019)*
    a. uniform speed.   b. uniform acceleration.
    c. average speed.   d. relative speed.

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11. A car covers 180 metres in two seconds, so its speed equals .... *(Matrouh 2019)*
    a. 90 m/sec.   b. 180 km/h.   c. 25 km/h.   d. 45 m/sec.

12. If the speedometer of a moving car points to 90 km/h, therefore after two hours the car covers ....
    a. 90 m.   b. 180 m.   c. 90 km.   d. 180 km.

13. If the uniform speed of a car is 72 km/h, so its speed (in m/sec.) equals ....
    a. 20 m/sec.   b. 25 m/sec.   c. 18 m/sec.   d. 40 m/sec.
    (Sohag, Gharbia 2020)

14. If a car moves at a uniform speed, where it covers 300 metres in a half minute, then its speed equals .... metre/second. *(Ismailia 2014)*
    a. 300   b. 30   c. 10   d. 150

15. If the uniform speed of a car is 108 kilometres/hour, so its speed equals .... m/sec.
    a. 10   b. 20   c. 30   d. no correct answer
    (Beni Suef 2014)

16. A car moves at a regular speed equals 90 km/h, this means that the car covers a distance equals .... metres in 40 sec. *(South Sinai, New Valley 2019)*
    a. 4000   b. 25   c. 2000   d. 1000

17. When the body covers equal distances at unequal intervals of time, this means that the body moves at .... *(Luxor 2019)*
    a. non-uniform speed.   b. increasing acceleration.
    c. uniform speed.   d. decreasing acceleration.

18. In case of motion that is described as movement at an irregular speed, in this case, it is useful to refer to another term which is the .... speed. *(Dakahlia 2018)*
    a. uniform   b. scalar   c. vector   d. average

19. A person takes a time of 10 minutes to transfer from home to work moving at an average speed of 3 m/sec. Which of the following equals the distance between home and work ? ....
    a. 600 m.   b. 1.8 km.   c. 60 m.   d. 1.2 km.   *(Alex. 2016)*

20. 📖 A car moving on a straight line covers a total distance (d) in a total time (t), the average speed of the car is given by .... *(Alex. 2013 / Red Sea 2014)*
    a. $\overline{V} = \dfrac{d}{t}$ b. $\overline{V} = dt$ c. $\overline{V} = \dfrac{t}{d}$ d. $\overline{V} = \dfrac{h}{km}$

21. A runner ran the 1st 100 metres of a race in 8 seconds and the 2nd 100 metres in 12 seconds, therefore his average speed during the whole race is ....
    a. 8 m/sec.   b. 10 m/sec.   c. 12 m/sec.   d. 20 m/sec.

22. The speed of a moving object relative to an observer in another moving object is called .... speed.
    a. uniform   b. irregular   c. average   d. relative   *(Cairo 2019)*

23. If the relative speed of a car is 50 km/h relative to an observer in a bus moves in the same direction at 70 km/h, therefore the actual speed of this car is ....
    a. 20 km/h.   b. 70 km/h.   c. 120 km/h.   d. 170 km/h. *(Behira 2020)*

24. If car (A) moves at speed 80 km/h and car (B) moves at speed of 50 km/h in the same direction, the speed of car (A) relative to a passenger in car (B) is .... km/h.
    a. 50   b. 80   c. 30   d. 130   *(Behira 2018)*

25. An observer in a moving car with 80 km/h was observing a moving car with 90 km/h in the same direction, so the observed speed of the second car is ....
    a. 10 km/h.   b. 80 km/h.   c. 90 km/h.   d. 170 km/h. *(Alex. 2019)*

26. The relative speed of a moving object relative to an observer moves at the same speed in the opposite direction is .... the actual speed.   *(Luxor 2017)*
    a. double   b. the same   c. half   d. quarter

2. Correct the underlined words :

1. The motion in one direction in a <u>curved</u> line is considered the simplest type of motion.

2. If car (A) took a shorter time than car (B) to cover the same distance, so car (A) was <u>slower</u> than car (B).

3. If car (A) covered a shorter distance than car (B) at the same time span, therefore car (A) was <u>faster</u> than car (B).

4. From speed measuring units are <u>metre/second^2</u> or kilometre/hour.   *(Suez, Assiut 2019)*

5. The <u>compass</u> helps in identifying the speed of the car directly.   *(Minia, Gharbia 2020)*

6. When a moving object covers equal distances at equal periods of time, so it moves with <u>relative</u> speed.   *(Cairo 2018)*

7. The <u>acceleration</u> is the change of the distance through a unit time.   *(Luxor 2018)*

8. When the object covers the double of distance at the same time, so its speed <u>decreases to quarter</u>.   *(Kalyoubia 2020)*

9. A car moves at a regular speed equals 20 m/sec. , this means that the car covers <u>60 m</u> in the third second.

10. Ahmed takes 10 minutes to transfer from his home to work moving at an average speed of 3 m/sec., the distance between home and work <u>equal 3</u> km.   *(Dakahlia 2020)*

11. A car moves at a regular speed covers 500 metres in 25 sec., so its speed is <u>200</u> m/sec.   *(Damietta 2016)*

12. A moving car covers a distance of 200 km through 150 min, so its speed is <u>90</u> km/h.   *(Giza 2019)*

13. If the uniform speed of a car is 25 m/sec, this means that its speed equals <u>72</u> km/h.   *(Beni Suef 2020)*

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14. A moving car covers 180 km in two hours, so its speed is <u>50 m/sec.</u> *(Dakahlia 2015)*

15. A moving car covers 20 metres in one second, so its speed is <u>90 km/h.</u> *(Dakahlia 2016)*

16. <u>Relative speed</u> represents the regular speed by which the moving object moves to cover equal distances at equal periods of time. *(Cairo 2020)*

17. If the value of the speed $(V) = \dfrac{d_1 + d_2 + d_3}{t_1 + t_2 + t_3}$, this means that this speed is <u>increased.</u>
(Ismailia, Sharkia 2017)

18. <u>Average</u> speed is the speed of a moving object relative to an observer. *(Dakahlia 2019)*

19. The value of a car speed relative to an observer standing on the ground is <u>the same</u> to an observer in another moving car.

20. <u>Relative speed</u> equals the total distance covered by the moving object divided by the total time taken to cover this distance. *(Red Sea 2015)*

21. Measuring the relative speed of a moving car depends on <u>the time.</u> *(Red Sea 2020)*

22. If two cars moving in the same direction at the same speed equals 100 m/sec., so the relative speed equals <u>200 m/sec.</u> *(Beni Suef 2018)*

23. The relative speed of two moving bodies in the same direction equals <u>the sum of their</u> speeds. *(Menofia 2016, 2018)*

24. The moving car with a certain speed seems to be at <u>high speed</u> to the moving observer at the same speed and the same direction. *(Menofia 2017)*

25. The relative speed of a moving car relative to an observer at rest is <u>less than</u> the real speed. *(Giza 2018 / Dakahlia 2020)*

3. Write the scientific term of each of the following :

1. • The change in the position of an object by the time passes relative (according) to the position of another fixed object. *(Cairo, Suez 2020)*

   • The change of an object position as time passes according to a fixed position.
   (Kalyoubia 2018)

2. • 📖 The distance that a moving object covers within a unit time. *(New Valley 2017)*

   • The distance moved through a unit time. *(Cairo 2019)*

   • The result of dividing the distance over time.

3. • The result of multiplying the speed of a body by the time. *(Menia 2018)*

   • The result of multiplying half the speed of a body by double of the time. *(Luxor 2019)*

4. The measuring unit of speed.

5. An instrument used in cars and planes to identify speed directly.

6. 📖 A moving object covers equal distances at equal periods of time. *(Giza 2014)*

7. The speed by which the object moves to cover equal distances at equal periods of time.
(Behira 2018 / Beni Suef 2020)

8. The thing which moves at constant speed in the space. *(Kalyoubia 2014 / Red Sea 2016)*

9. The speed of a moving body that covers equal distances at unequal time span.
(Kalyoubia 2019 / Fayoum 2020)

10. • 📖 The total distance that a moving object covers divided by the total time taken to cover this distance. *(Assiut, Suez 2020)*

   • The regular speed by which the moving object moves to cover the same distance at the same period of time. *(Behira, Dakahlia 2019)*

11. • The speed of a moving object relative to the observer.
(Alex., Beni Suef, New Valley 2020)

   • 📖 The value of an object speed relative to the observer. *(Ismailia, South Sinai 2019)*

   • The speed of a moving object relative to a constant (fixed) or a moving observer.
(Sharkia, Sohag 2019)

4. Complete the following statements :

1. When the object position changes as time passes according to the position of another fixed object, we can say that the first object is in a state of .... , while if the first object remains at the same position said that it is in a .... state. *(Assiut 2013)*

2. The change of an object position as time passes according to the position of another fixed object is called .... *(Gharbia 2019)*

3. The two factors which can be used to describe the motion of the body are .... and .... *(Sharkia 2019 / Sohag 2020)*

4. The motion in a .... line in .... direction is considered the simplest type of motion.

5. The movement path may be .... or .... or combination of both. *(Port Said 2020)*

6. If car (A) takes a shorter time than car (B) to cover the same distance, therefore car .... is faster than car ....

7. 📖 .... is defined as the covered distance within a unit time. *(Giza 2018 / Gharbia 2020)*

8. 📖 The result of multiplying a speed of a moving object by time = ...
(Fayoum, Qena 2020)

9. 📖 Speed measurement units are .... or .... *(Sharkia 2017 / Assiut 2018)*

10. A car covers 80 metres in 4 seconds, so it moves at a speed equals .... m/sec.

11. A train which travels a distance of 360 km with a regular speed 120 km/h needs .... hours to cover this distance.

12. A car moves at speed of 180 km/h, so its speed equals .... m/sec. *(Beni Suef 2016)*

13. When an object covers equal .... at unequal periods of time, so it moves at .... speed.

14. 📖 The result of dividing the total distance that a moving object covers by the total time taken to cover this distance is .... *(Fayoum 2018)*

15. Average speed represents the .... speed, by which the moving object moves to cover the same .... at the same time taken to cover this distance. *(Gharbia 2018)*

16. A train travels from Cairo to Banha at a distance of 45 km in 1.5 hours, so its average speed equals ....

17. A red car moves on a road at a speed 80 km/h and a yellow car moves in the same direction at a speed of 70 km/h, so the passenger in the yellow car observes the red car moves at a speed equals ....

18. Two trains move in two parallel different ways in opposite directions, if the speed of first train is 120 km/h and the speed of the second train is 90 km/h, then the relative speed of first train that observed by passengers in the second train is .... *(Dakahlia 2016)*

19. The measuring of relative speed depends on the position of the .... who determines the magnitude of this speed. *(Ismailia 2018 / Port Said 2019)*

20. The speed of the moving object relative to the observer is .... speed. *(Gharbia 2017)*

21. If a car moves at a speed of 50 km/h and it seems to an observer at a speed 110 km/h, therefore the speed of the moving observer is .... km/h and in the .... direction of the car's motion. *(Luxor 2018)*

22. The real speed of a car moves at a relative speed 70 km/h relative to an observer moves in the opposite direction by a speed 40 km/h is .... *(Red Sea 2018 / Beni Suef 2019)*

5. 📖 **Complete the missing parts in the table :** *(Kafr El-Sheikh, South Sinai 2019)*

Speed (m/sec.)	Distance (metre)	Time (second)
..........(a)..........	100	5
5	..........(b)..........	10
8	96	..........(c)..........

6. **Give reasons for :**

1. The motion of a train (or metro) can be considered from examples of motion in one direction. *(Dakahlia 2018 / North Sinai 2020)*

2. • Cars and planes are provided with speedometers.

   • The importance of speedometer in cars and planes. *(Menofia, Port Said 2018)*

3. The object speed increases by decreasing the time needed to cover a certain distance. *(Aswan 2017 / Dakahlia 2020)*

4. The speed of a moving object increases as the covered distance increases at a constant time.

5. Car (A) which covers 50 metres in 5 seconds is faster than car (B) which covers 64 metres in 8 seconds.

6. Most of moving cars cannot move inside crowded towns all the time by uniform speed.

   (Fayoum, South Sinai 2020)

7. • The Metro moves at an irregular speed. *(Red Sea 2014)*

   • The train moves at an irregular speed. *(Giza 2015, 2020)*

8. The relative speed of a moving object in a certain direction differs according to the difference of the observer state.

9. A moving observer can't accurately determine the actual speed of a moving object.

10. A moving car seems stable (at rest) to an observer moves at the same speed and the same direction. *(Aswan, Gharbia 2020)*

11. The relative speed of car relative to a moving observer equals zero. *(Giza 2020)*

7. Define each of the following :

1. Motion. *(Red Sea 2011 / Behira 2017)*

2. Speed. *(Damietta 2016)*

3. 📖 Uniform (Regular) speed. *(Aswan, Fayoum 2019)*

4. Non-uniform (Irregular) speed. *(Red Sea 2018 / Cairo 2019)*

5. 📖 Average speed. *(Gharbia, Sharkia 2019 / Cairo 2020)*

6. Relative speed. *(Fayoum, Port Said 2020)*

8. When do we say that ...?

1. An object moves by the simplest type of movement. *(Alex. 2018)*

2. The amount of an object's speed is equal to the amount of distance covered.

3. An object moves at a regular speed.

4. An object moves at an irregular speed. *(Alex. 2018)*

5. The relative speed of a moving object relative to an observer is :

   (a) equal to its real speed.

   (b) more than its real speed.

   (c) less than its real speed.

   (d) double its real speed.

6. • The relative speed of a moving body equals zero. *(Behira 2017 / Matrouh 2018)*

   • A moving object seems static relative to a moving observer.

9. What is meant by each of the following ...?

1. The change of an object location as time passes. *(Gharbia 2012)*

2. 📖 An object moving in a straight line, covers a distance of 20 metres in one second.
(North Sinia 2015)

3. 📖 A moving car covers a distance of 100 km in two hours. *(Giza, North Sinai 2019)*

4. A car covers equal distances at equal periods of time. *(Beni Suef 2015)*

5. The distance covered by an object is changed by 2 metres each second. *(Luxor 2019)*

6. The distance covered by an object is changed by 15 m each 3 seconds. *(Luxor 2018)*

7. The speed of a moving object equals 100 km/h. *(Kafr El-Sheikh 2018)*

8. A body moves at a uniform speed equals 5 m/sec. *(Menia 2018)*

9. The speed of a body equals zero. *(Port Said 2018)*

10. 📖 A car moving at a uniform speed equals 80 km/h. *(Qena, Port Said 2019)*

11. A moving car covers equal distances at unequal periods of time.

12. 📖 The average speed of a moving car is 70 km/h. *(Port Said, Beni Suef 2019)*

13. The average speed of a moving car is 60 km/h. *(Gharbia 2017)*

14. The relative speed of a car related to a moving observer equals zero. *(Matrouh 2017)*

15. The relative speed of a train equals 90 km/h. *(Giza 2014 / Kalyoubia 2015)*

16. The relative speed of a moving car equals 70 km/h relative to an observer which moves in the opposite direction at a speed of 20 km/h.

10. Compare between :

1. Regular speed and irregular speed. [according to definition] *(Kalyoubia, Qena 2020)*

2. Regular speed and average speed. [according to definition, law used and measuring unit]

3. Average speed and irregular speed. [according to definition] *(Matrouh 2018 / Gharbia 2020)*

4. Average speed and relative speed. [according to definition] *(Aswan 2016 / Kafr El-Sheikh 2019)*

5. A train covers 72 km in an hour and a car covers 30 m in one second.
[in the term of the magnitude of speed] *(Menofia 2020)*

11. What are the two factors that can be used to describe the body motion ?
(Port Said 2011)

12. Mention the use of a speedometer.
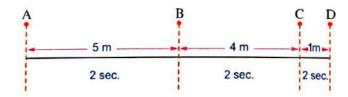*(Fayoum 2019 / Aswan 2020)*

13. Which of the following moves at a higher speed ? And why ? *(Beni Suef 2014)*

1. A train moves at 90 km/h.

2. A car covers 40 metres in two seconds.

14. Problems :

1. A runner covers 450 metres in 45 seconds. Find his speed.

2. A train travels from Cairo to Alexandria a distance of 250 km in 2 hours. Find its speed.

3. A train covers 50 m in two seconds. Find its speed in km/h.   *(Sharkia 2016 / Giza 2017)*

4. A train starts to move at 7 o'clock in the morning, then what is the time of arrival if it moves at speed of 100 km/h to cover the distance of 500 km.   *(Damietta 2017, 2020)*

5. A bus covers a distance of 120 km at a speed of 90 km/h, then it covers 105 km at 70 km/h. Calculate the time needed to cover the whole distance.

6. A car moving at a uniform speed equals 80 km/h. Find its speed in m/sec.

7. One of the foxes attacked a deer at rest. If the average speed of the fox is 120 km/h, calculate the distance (by km and metres) covered by the fox to catch the deer if the time taken is 10 sec.

8. A body moves at a regular speed (m/sec.) according to the following mathematical equation $d = 6 t$. Find :

    (a) The speed of this body.

    (b) The time needed to cover 360 m.

9. Study the following figure, then answer the following :

A body moves from starting point (A) to ending point (D) as the shown distances and times in the figure.

Does this body move at regular or irregular speed ? Why ?

10. If Ahmed walked at speed 1.5 m/sec. for 30 sec. and Ali walked at speed 2 m/sec. for 15 sec. then walked at another speed 1 m/sec. for 15 sec.

    Which one of them has the larger average speed ?

11. Calculate the average speed of a car that moves in a circular path whose length is 300 m for 10 rounds in 3 minutes. *(Menia 2013)*

12. A moving object covers a distance of 20 m through 4 sec., then it covers 40 m through 11 sec. Calculate the average speed of the object. *(Behira 2014 / Fayoum 2017)*

13. A moving car (A) in a straight line measures the relative speed of a car (B) which was moving in the opposite direction, it found that the relative speed of the car (B) was 140 km/h and when the car (A) reduces its speed to half, it found that the relative speed of the car (B) becomes 100 km/h. Calculate the real speed of the two cars. *(Luxor 2019)*

14. **A body moves in a straight line and the distance covered in different times is recorded in the opposite table.**

Distance (m)	10	20	30	40
Time (second)	5	10	15	20

(a) Calculate the body speed.

(b) What is the type of the speed ? *(Damietta 2012)*

15. **A body moves in a straight line at a regular speed and the distance covered in different times is recorded in the opposite table.**
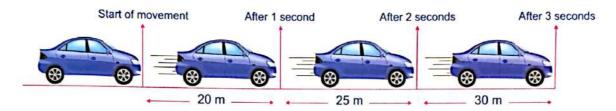
Distance (m)	4	8	12	(X)	20
Time (second)	2	4	6	8	(Y)

(a) Calculate the speed of the body.

(b) What is the value of (X) and (Y) ?

16. A body covers a distance of 20 km through 4 minutes, then it covers 40 km through 12 minutes. Calculate the average speed of the body. *(Sohag, North Sinai 2018)*

17. A student on a bike takes a time of 15 minutes to transfer from his home to his school moving by average speed 5 m/sec. What is the distance between his home and his school in km ? *(Port Said 2016)*

18. 📖 A boy on a bike covers 300 metres in a minute and 420 metres in the following minute. Calculate his average speed during the : *(Aswan 2018)*

(a) First minute.   (b) Second minute.   (c) Two minutes together.

19. Two cars move in a straight line, car (A) moves at 20 m/sec, while car (B) moves at 25 m/sec. Calculate :

(a) The distance covered by each car after one minute.

(b) The time taken by each car to cover a distance of 100 m. *(Suez 2011)*

20. A student takes a time of 15 minutes to reach his school, when he moves at an average speed (2 m/sec). Calculate the total distance covered by the student, when he goes to school and returns back again to his starting point. *(Kalyoubia 2018)*

21. A racer ends the race in 2 hours with average speed 25 km/h. If you know that the racer covers the first 15 km in an hour. Calculate the speed of the racer after the first hour to complete the race in the given time. *(Behira 2018)*

22. **Study the following figure, then answer the following :**

Start of movement   After 1 second   After 2 seconds   After 3 seconds

— 20 m —   — 25 m —   — 30 m —

  (a) Does the car move at a regular speed ? Why ?

  (b) Calculate the car speed during the :

    1. First second.   2. Third second.

  (c) What is the average speed of the car during the three seconds together ?

23. A moving body covers a distance equals 80 metres in 2 seconds, then covers a distance equals 120 metres in 3 seconds.

Does such body move at a regular speed ? Why ? *(Giza 2016)*

24. **A racer covered a distance of 50 metres of a straight track in 5 seconds, then he returned back walking, he took 20 seconds to come back to the starting point of running. Calculate the racer's average speed :** *(Gharbia 2018 / Giza 2020)*

  (a) While running.

  (b) While returning.

  (c) During the whole trip.

25. A boy rode a bike and covered 90 km at an average speed equals 36 km/h but he covered the first thirty km in two hours. What is the average speed at which the remaining distance was covered ?

26. A car driver covered a distance equals 3000 m in 100 sec. If the first thousand metres were covered by an average speed equals 20 m/sec. Calculate the average speed at which the remaining distance was covered.

27. A body moves in straight line with a speed 3 m/sec for 30 m distance, then he moves on the same line for 120 m with a speed 6 m/sec., calculate the average speed for this body from the begining of the movement to the end ? *(Luxor 2020)*

28. Calculate the actual speed to the car, whose relative speed is 130 km/h relative to an observer moving in the same direction at a speed of 50 km/h. *(Menia 2016)*

29. Calculate the actual speed of the car, whose relative speed is 80 km/h relative to an observer moving in the opposite direction at a speed of 30 km/h. *(Giza 2019)*

30. **Two cars move in the same direction, If the speed of the first car is 50 km/h and the speed of the second car is 70 km/h. Calculate the relative speed of the second car relative to an observer :**

    (a) Standing on the ground. (b) Sitting in the first car. *(Dakahlia 2019)*

    (c) What are you conclude from the resultants.

31. Two trains move parallel to each other but in the opposite direction, the speed of the first train is 60 km/h and the speed of the second train is 90 km/h. Calculate the relative speed of the first that is observed by passengers in the second train. *(Matrouh 2017)*
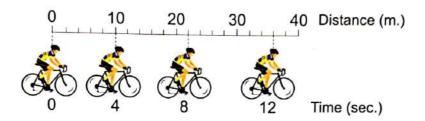
32. **Two race cars, the first car moves at a speed of 80 km/h , while the second car moves at a speed of 120 km/h in the same direction. Mention the following :**

    (a) The relative speed of the first car relative to an observer standing on one side of the race road. *(Cairo 2018 / Sharkia 2020)*

    (b) The relative speed of the second car relative to a passenger in the first car.
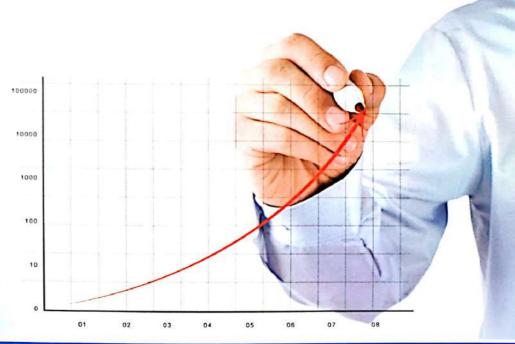
Timss Questions

1. The following figure shows the bicyclist movement within 12 sec. from the beginning of his movement. Calculate the average speed during this period with unit km/h.

2. In a football game. The ball was in one corner of the stadium at a distance of 50 metres from a player who has a speed of 3 m/sec., and at a distance of 35 metres from another player who has a speed of 2 m/sec. Which of the two players catches the ball first ?

3. In auto racing, there were two check points, the distance between them 160 km and the racers must cut this distance in two hours and a half to win the largest number of points :

(a) Calculate the speed that a racer must run at, to cover the required distance in the specified time.

(b) If one of the racers covers from the start of the race a distance 40 km in hour across the road on a hill. Calculate the speed at which the racer must move to cover the remaining distance in specified time.

4. A bicyclist covers 45 km at average speed equals 18 km/h, but he covers the first fifteen kilometres in an hour. What is the speed which covers the rest of the distance ?

5. If the relative speed of the steamship is 550 km/h as it monitored by aircraft moving in the opposite direction at a speed of 425 km/h.

What is the time taken by the steamship from the moment of monitoring the plane for its movement until it arrives at the port at a distance of 60 km ?

6. Samy came out from his home at seven o'clock and quarter at morning. Will he attend the school queue ? which started at seven o'clock and half, assuming he moves at a regular speed equals 15 m/min., knowing that the distance between his home and the school equals 180 m.

7. If the relative speed of a car equals 120 km/h, and a radar observes it which is found in another car moving at a speed of 50 km/h in the opposite direction. Does the car infraction the maximum speed on this road which is 90 km/h ? Explain your answer mathematically.

Graphic Representation of Moving in a Straight Line

What is the importance of graphs and tables to physicists ?

- Physical phenomena can be described and understood in many ways.
- Mathematicians use mathematical relations between variables to describe certain phenomena.

⊙ **Physicists use other mathematical relations like graphs and tables GR in order to :**

- predict the relation between certain physical quantities.
- understand practical results.
- describe the physical phenomena in an easier way.

- This lesson will include the graphic representation of regular speed and regular acceleration.

Graphic representation of regular (uniform) speed

Activity To represent the uniform speed graphically.

Tools :
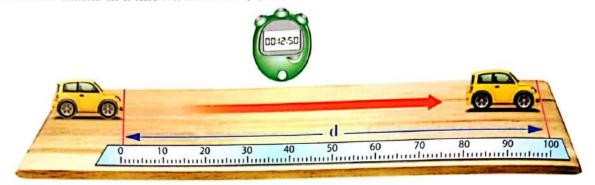
- A toy car operated by a battery.
- A metric strip (or ruler).
- A marker.
- A smooth wooden board.
- A stop watch.

المعاصر علوم لغات (شرح) /٣ع/تيرم ١ (م : ٦) **41**

▶ Procedures :
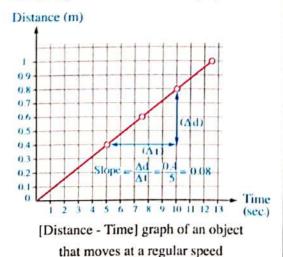
1. Place the wooden board at a horizontal position.
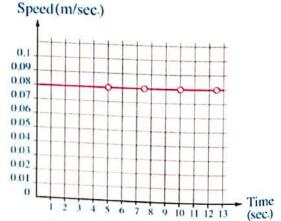2. Put two marks at a known distance (d) as shown in the following figure.

3. Operate the car and calculate the time (t) necessary to cover this distance (d).
4. Repeat the previous steps by changing the distance (d) and calculate the time needed in each trial.
5. Write the results in a table (as shown below).
6. Calculate the speed of the car in each trial from the relation $V = \dfrac{d}{t}$

Number of trial	Covered distance (d) in metre	Time (t) needed to cover this distance in second	Speed V = d/t (m/sec.)
①	0.4	5	0.08
②	0.6	7.50	0.08
③	0.8	10	0.08
④	1.0	12.50	0.08

7. Use the previous table to draw a graph to illustrate the relation between :

- **Distance** (d) on the vertical [Y] axis.
- **Time** (t) on the horizontal [X] axis.

- **Speed** (V) on the vertical [Y] axis.
- **Time** (t) on the horizontal [X] axis.

[Distance - Time] graph of an object that moves at a regular speed

[Speed - Time] graph of an object that moves at a regular speed

▶ *Observation & Conclusion :*

The motion at a regular speed represents

in

The relation *(distance - time)*	**The relation** *(speed - time)*
as	*as*
a straight line passing through the origin point (the intersection point of the two axes). **GR**	*a straight line parallel to the time axis (X).* **GR**
Because the distance is directly proportional to the time when the object moves at a constant speed.	**Because the object speed remains constant as time passes.**
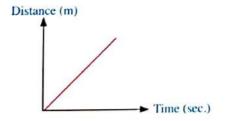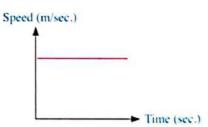
❋ **From the previous activity, we can clarify some facts about regular speed in a straight line :**

1. The **(distance - time)** graph of a regular motion at a constant (uniform) speed is represented by a straight line passing through the origin point.
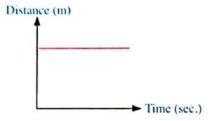

Distance (m) / Time (sec.)

2. The **(speed - time)** graph of a regular motion at a constant (uniform) speed is represented by a straight line parallel to the time axis.
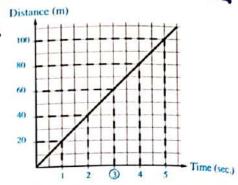

Speed (m/sec.) / Time (sec.)

✎ **..Note**

The **(distance - time)** graph of **an object at rest** is represented by a straight line parallel to the time axis.

Distance (m) / Time (sec.)

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Problems

(1) *The opposite graph represents the motion of a body.*

Distance (m)

1. Mention the kind of the speed of this body. Giving a reason.
2. Calculate the speed of this body.
3. Calculate the distance covered by this body after 3 and 10 seconds.

Solution

1. The body moves at a regular (uniform) speed, because the (distance - time) graph is a straight line passing through the origin point (it covers equal distances at equal time intervals).

2. $V = \text{Slope} = \dfrac{d}{t}$ at any point $= \dfrac{20}{1} = \dfrac{40}{2} = \ldots\ldots = 20$ m/sec.

3. The distance covered by this body :

- After 3 seconds : $d = V \times t = 20 \times 3 = 60$ metres. (As shown in the graph).
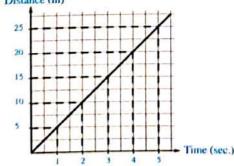- After 10 seconds : $d = V \times t = 20 \times 10 = 200$ metres.

(2) *The following table represents the distances covered by a moving body through different time intervals.*

1. Represent the relation graphically.
2. Calculate the speed from the graph.
3. Mention the kind of speed. Giving a reason.

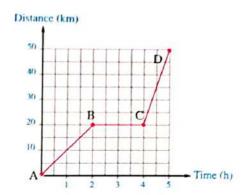| Distance (m)	5	10	15	20	25
Time (sec.)	1	2	3	4	5

Solution

1. Distance (m)

2. The speed $= \dfrac{10}{2} = \dfrac{15}{3} = 5$ m/sec.

3. Regular speed, because (distance - time) graph is a straight line passing through the origin point. (ratio d/t is constant).

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3 *The opposite graph represents a bike motion through 5 hours :*

1. Calculate the average speed of the bike during the trip.

2. What is the period in which the bike stops ? And what is the time of this stopping ?

3. What are the periods during which the bike moves at a regular speed ? And what is the period during which the regular speed of the bike is the greatest ?
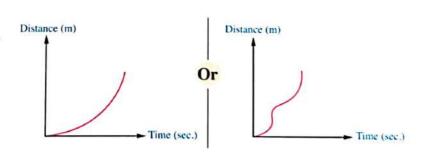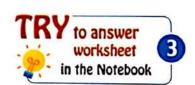
Solution

1. Average speed $(\overline{V}) = \dfrac{\text{Total distance(d)}}{\text{Total time(t)}} = \dfrac{50}{5} = 10$ km/h.

2. The stopping period = (BC)

   Time of stopping = $4 - 2 = 2$ hours.

3. • The periods during which the bike moves at a regular speed : (AB) and (CD).

   • The speed in the period (AB) = $\dfrac{20}{2} = 10$ km/h.

   • The speed in the period (CD) = $\dfrac{50 - 20}{5 - 4} = 30$ km/h.

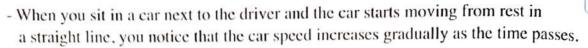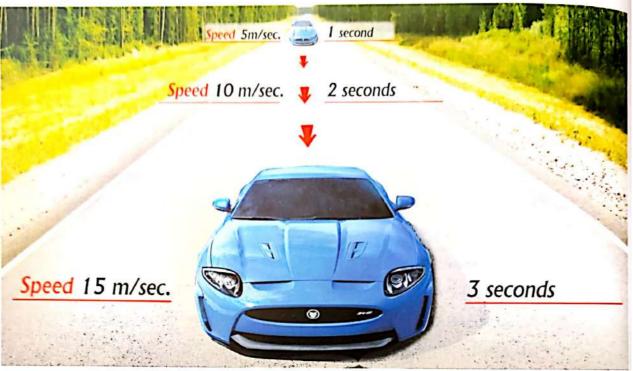   ∴ The regular speed for the bike is the greatest in the period (CD).

Note

The relation (distance - time) graph for an object moves at a non-uniform speed is represented as a curved line passing by the origin point.
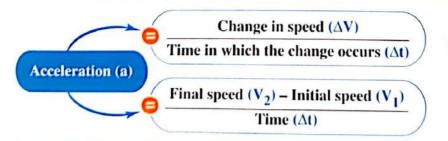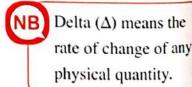
Or

TRY to answer worksheet **3** in the Notebook

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Acceleration

- When you sit in a car next to the driver and the car starts moving from rest in a straight line, you notice that the car speed increases gradually as the time passes.

Speed 5m/sec. — 1 second

Speed 10 m/sec. — 2 seconds

Speed 15 m/sec. — 3 seconds

From the example above :

When the speed of the car at **1 second** becomes **5 m/sec.**, at **2 seconds** becomes **10 m/sec.**, at **3 seconds** becomes **15 m/sec.** and so on.

- To describe the change in the car speed in one second in this case, we use a physical quantity called "**acceleration**".

Acceleration

Or It is the change of an object speed in one second in a specific direction.
It is the rate of change of speed.

$$\text{Acceleration (a)} = \frac{\text{Change in speed } (\Delta V)}{\text{Time in which the change occurs } (\Delta t)}$$

$$= \frac{\text{Final speed } (V_2) - \text{Initial speed } (V_1)}{\text{Time } (\Delta t)}$$

NB Delta (Δ) means the rate of change of any physical quantity.

Measuring units of acceleration :

$$\text{Acceleration unit} = \frac{\text{Speed unit}}{\text{Time unit}} = \frac{\dfrac{\text{metre}}{\text{second}}}{\text{second}} = \frac{\text{metre}}{\text{second}} \times \frac{1}{\text{second}} = \frac{\text{metre}}{\text{second}^2} = \textbf{metre/second}^2.$$
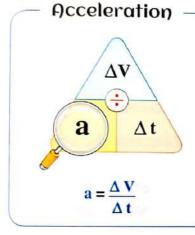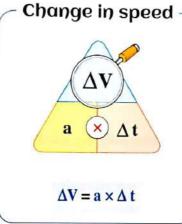
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Note

We use the acceleration unit (m/sec^2) when the speed is measured in metre/second and the time is measured in second or (km/h^2) when the speed is measured in kilometre/hour and the time is measured in hour.
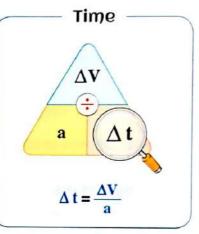
Guidelines to solve problems on acceleration :

1. To calculate : **Acceleration . Change in speed and Time**, we use the following relations :

— **Acceleration** —   — **Change in speed** —   — **Time** —

$$a = \frac{\Delta V}{\Delta t}$$

$$\Delta V = a \times \Delta t$$
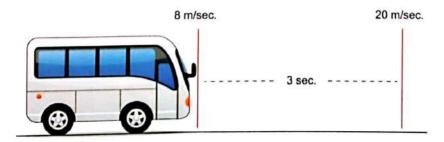
$$\Delta t = \frac{\Delta V}{a}$$

2. If the body is moving at a regular speed, so its acceleration equals zero **GR.** because its speed doesn't change as time passes [when (ΔV) = Zero, then (a) = Zero].

3. If the body starts moving from rest, so its initial speed (V_1) equals zero.

4. When the body stops moving, so its final speed (V_2) equals zero.

5. When the car is moving, then the brake is applied to stop the car after a period of time so, its final speed equals zero.

Problems

1 If a bus moves in a straight line, its speed changes from 8 m/sec. to 20 m/sec. within a period of 3 seconds. What is the amount of acceleration ?

8 m/sec.   20 m/sec.

- - - - - - - 3 sec. - - - - - - -

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Solution

$V_2 = 20$ m/sec. $\qquad$ $V_1 = 8$ m/sec $\qquad$ $\Delta t = 3$ sec.

$$\text{Acceleration (a)} = \frac{V_2 - V_1}{\Delta t} = \frac{20 - 8}{3} = 4 \text{ m/sec}^2$$

② *Car (A) starts movement from rest and then its speed increases to 60 m/sec. through 5 seconds, while car (B) starts movement from rest and then its speed increases to 80 m/sec. through 10 seconds. Which of the two cars is moving at a greater acceleration ?*

Solution

$$\text{Acceleration of car (A)} = \frac{V_2 - V_1}{\Delta t} = \frac{60 - 0}{5} = 12 \text{ m/sec}^2$$

$$\text{Acceleration of car (B)} = \frac{V_2 - V_1}{\Delta t} = \frac{80 - 0}{10} = 8 \text{ m/sec}^2$$

∴ Car (A) moves at a greater acceleration than car (B).

③ *An object moves at an initial speed that equals 7.5 m/sec. Calculate the amount of time at which the final speed of the object becomes four times as its initial speed. Knowing that the object moves at acceleration equals 10 m/sec?*
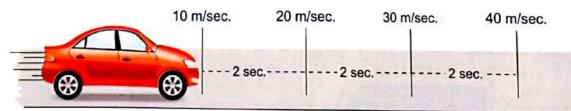
Solution

$V_2 = 4 \times V_1 = 4 \times 7.5 = 30$ m/sec.

$$\Delta t = \frac{\Delta V}{a} = \frac{V_2 - V_1}{a} = \frac{30 - 7.5}{10} = \frac{22.5}{10} = 2.25 \text{ sec.}$$

Uniform acceleration :

- When a car covers equal distances at equal periods of time , it is said that the car moves at a **uniform (regular) speed**.

- But if its speed changes (decreases or increases) by equal values at equal periods of time, it is said that the car moves at a **uniform (regular) acceleration**.

- **In the above figure :**

The speed of the car increases by 10 m/sec each 2 sec, so :

$$\text{Acceleration (a)} = \frac{20 - 10}{2} = \frac{30 - 20}{2} = \frac{40 - 30}{2} = 5 \text{ m/sec}^2$$

Uniform acceleration

It is the acceleration by which an object moves in a straight line when its speed changes by equal values through equal periods of time.

What is meant by ... ❓

A car moves at a uniform acceleration equals 5 m/sec².

➲ This means that the car moves in a straight line and its speed changes with 5 m/sec. each one second.

Types of uniform acceleration :

Positive acceleration	Negative acceleration

If we assume that

An object Ⓐ	An object Ⓑ
Starts its movement from rest in a straight line and its **speed increases** regularly until it reaches 50 m/sec.	**Moves** at 50 m/sec. in a straight line and its **speed decreases** regularly until it stops.
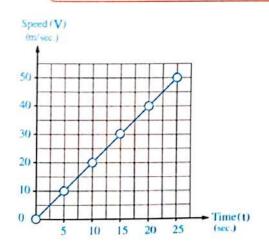
The speed is recorded each 5 seconds in the following table :
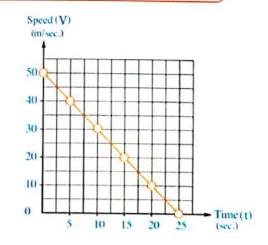
Time (sec.)	Zero	5	10	15	20	25
Speed (m/sec.)	Zero	10	20	30	40	50

Time (sec.)	Zero	5	10	15	20	25
Speed (m/sec.)	50	40	30	20	10	Zero

We can represent the previous values in the following graph :

[Speed-Time] graph of an object that moves at **a positive acceleration**.

[Speed-Time] graph of an object that moves at **a negative acceleration**.

Scanned with CamScanner

We can conclude :

Initial speed

$V_1 = $ Zero

$V_1 = 50$ m/sec.

Final speed

$V_2 = 50$ m/sec.

$V_2 = $ Zero

Time period

$\Delta t = 25$ sec.

$\Delta t = 25$ sec.

Acceleration

$a = \dfrac{50 - 0}{25} = $ ⊕ 2 m/sec^2.

$a = \dfrac{0 - 50}{25} = $ ⊖ 2 m/sec^2.

- The sign ⊕ refers to the speed of the object increases regularly by 2 m/sec. each one second.

- The sign ⊖ refers to the speed of the object decreases regularly by 2 m/sec. each one second.

So, we can say that :

The object **(A)** moves at a uniform positive acceleration (accelerating motion).

[Its initial speed < Its final speed].

The object **(B)** moves at a uniform negative acceleration (decelerating motion).

[Its initial speed > Its final speed].

Positive acceleration

It is an acceleration by which an object moves in a straight line when its speed increases by equal values through equal periods of time.

Negative acceleration

It is an acceleration by which an object moves in a straight line when its speed decreases by equal values through equal periods of time.

What is meant by ... ❓

An object moves at a positive acceleration equals 2 m/sec^2.

➲ This means that the object moves in a straight line and its speed **increases** by 2 m/sec. each one second.
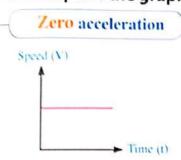
What is meant by ... ❓

An object moves at a negative acceleration equals –2 m/sec^2.

➲ This means that the object moves in a straight line and its speed **decreases** by 2 m/sec. each one second.

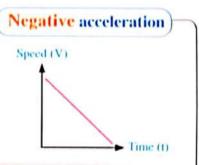* From the previous explanation, we can deduce the type of acceleration from the shape of the graph :

Zero acceleration	Positive acceleration	Negative acceleration
Speed (V) ↑ Time (t) →	Speed (V) ↑ Time (t) →	Speed (V) ↑ Time (t) →

when

The object moves at **(a uniform speed)** $V \text{ (initial)} = V \text{ (final)}$	The object moves at **(a non-uniform speed)** $V \text{ (initial)} < V \text{ (final)}$ So, it moves at an **accelerating** motion.	The object moves at **(a non-uniform speed)** $V \text{ (initial)} > V \text{(final)}$ So, it moves at a **decelerating** motion.

Problems

① **An object moves from rest and its speed reaches 20 m/sec. in 5 seconds.**

1. Calculate the acceleration of the moving object.
2. What is the type of acceleration ?

Solution

1. $V_1 = 0$ $V_2 = 20$ m/sec. $\Delta t = 5$ sec.

$$\because a = \frac{V_2 - V_1}{\Delta t}$$

$$\therefore a = \frac{20 - 0}{5} = 4 \text{ m/sec}^2.$$

2. Positive acceleration.

② **A train moves at a uniform speed of 20 m/sec. When the driver uses the brakes, the train stops after 4 sec. Calculate the acceleration at which the train moves and mention the type of acceleration.**

Solution

$V_1 = 20$ m/sec. $V_2 = 0$ $\Delta t = 4$ sec.

$$\because a = \frac{V_2 - V_1}{\Delta t}$$

$$\therefore a = \frac{0 - 20}{4} = -5 \text{ m/sec}^2.$$

It's decelerating motion.

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3 A car driver moves at a speed of 80 m/sec. used the brakes to make the car moves at a uniform decreasing acceleration 2 m/sec^2.
Find the car speed after 12 seconds from using the brakes.

Solution

$V_1 = 80$ m/sec.　　　　$a = -2$ m/sec^2.　　　$\Delta t = 12$ sec.　　　$V_2 = ?$

$\because \ a = \dfrac{V_2 - V_1}{\Delta t}$　　　　$\therefore \ -2 = \dfrac{V_2 - 80}{12}$

$\therefore V_2 = 56$ m/sec.

💡 **Guidelines to solve problems :**

On moving at a uniform speed through the period of time (AB) and then followed by the movement at a uniform acceleration through another period of time (BC). **So,**
The uniform speed through the period of time (AB) =
The initial speed through the period of time (BC)
[V_1 at point (B)].

A　　　　　　B　　　　　　　　　　C

4 An object moves in a straight line at a regular speed. If the time taken by the object to move from (A) to (B) is 4 seconds,
then it moves at a uniform acceleration from
point (B) until it stops at point (C) in 20 seconds. Calculate each of the following:

A　　　　　　B　　　　　　　　　　C
←— 40 m. —→ ←——— 100 m. ———→

1. The regular speed of the object to cover the distance (AB).
2. The uniform acceleration by which the object moves from point (B) to point (C).

Solution

1. Regular speed at (AB) $= \dfrac{\text{Distance}}{\text{Time}} = \dfrac{40}{4} = 10$ m/sec.

2. $\because$ The initial speed at (BC) = The uniform speed at (AB) = 10 m/sec.

$\therefore$ The uniform acceleration at (BC) (a) $= \dfrac{V_2 - V_1}{\Delta t} = \dfrac{0 - 10}{20} = -0.5$ m/sec^2.

5 A car moves at a speed of 60 m/sec., if the driver used the brakes to decrease the speed by 3 m/sec^2. Calculate the time after which the car stops.

Solution

$V_1 = 60$ m/sec.　　　　$V_2 = 0$　　　　　$a = -3$ m/sec^2.　　　$\Delta t = ?$
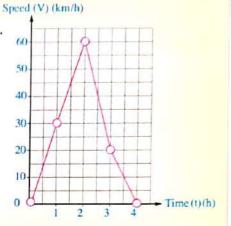
$\because \ a = \dfrac{V_2 - V_1}{\Delta t}$

$\therefore \Delta t = \dfrac{V_2 - V_1}{a} = \dfrac{0 - 60}{-3} = 20$ sec.

6 **The following table shows the motion of a car within 4 hours, describe this motion during that period of time.**
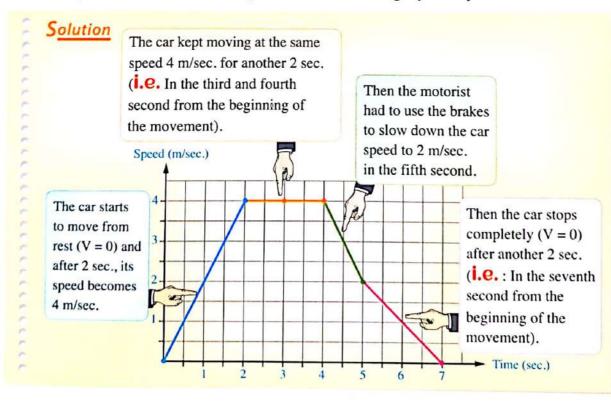
Time (t) (hour)	0	1	2	3	4
Speed (V) (km/hour)	0	30	60	20	0

Solution
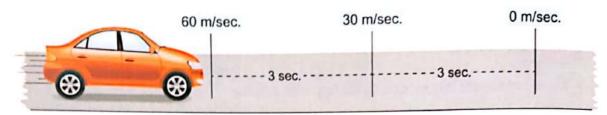
* We can represent this motion in the opposite graph.

- Through the first two hours, the car moves at

accelerating motion $= \dfrac{60-0}{2-0} = 30$ km/h^2.

- Through the third hour, the car moves at

decelerating motion $= \dfrac{20-60}{3-2} = -40$ km/h^2.

- Through the fourth hour, the car moves at

decelerating motion $= \dfrac{0-20}{4-3} = -20$ km/h^2.

7 **If a car starts to move from rest and after 2 sec. its speed becomes 4 m/sec. and it kept moving at the same speed for another 2 sec., then the motorist had to use the brakes to slow down the car speed to 2 m/sec. in the fifth second, and it stops completely after another 2 sec. Represent the relation graphically.**

Solution

The car kept moving at the same speed 4 m/sec. for another 2 sec. (**i.e.** In the third and fourth second from the beginning of the movement).

Then the motorist had to use the brakes to slow down the car speed to 2 m/sec. in the fifth second.

The car starts to move from rest (V = 0) and after 2 sec., its speed becomes 4 m/sec.

Then the car stops completely (V = 0) after another 2 sec. (**i.e.** : In the seventh second from the beginning of the movement).

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8 If a car moves at 60 m/sec., then after 3 seconds, its speed becomes 30 m/sec. and it stopped after another 3 seconds. Calculate the acceleration at which the car moves, mention its kind and represent this graphically.

60 m/sec.   30 m/sec.   0 m/sec.

------- 3 sec. ------- ------- 3 sec. ------

Solution

- During the 1st three seconds :

$V_1 = 60$ m/sec. $V_2 = 30$ m/sec.

$\therefore a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{30 - 60}{3} = -10$ m/sec^2.

- During the 2nd three seconds :

$V_1 = 30$ m/sec. $V_2 = 0$

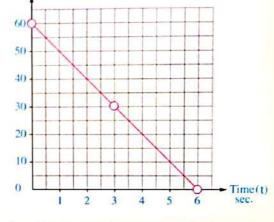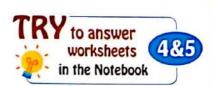$\therefore a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{0 - 30}{3} = -10$ m/sec^2.

Speed
(V) m/sec

i.e. The car moves at a uniform deceleration (negative acceleration).

TRY to answer worksheets **4&5** in the Notebook

Remember

Physicists use other mathematical relations like graphs and tables in order to :

- predict the relation between certain physical quantities.
- understand practical results.
- describe the physical phenomena in an easier way.

Acceleration :

- It is the change of an object speed in one second in a specific direction.

$$\text{Acceleration (a)} = \frac{\text{Final speed } (V_2) - \text{Initial speed } (V_1)}{\text{Time } (\Delta t)}$$

- Measuring units of acceleration is m/sec^2 or km/h^2.

Uniform acceleration :

It is the acceleration by which an object moves in a straight line when its speed changes by equal values through equal periods of time.

Positive acceleration :

It is an acceleration by which an object moves in a straight line when its speed increases by equal values through equal periods of time.

Negative acceleration :

It is an acceleration by which an object moves in a straight line when its speed decreases by equal values through equal periods of time.
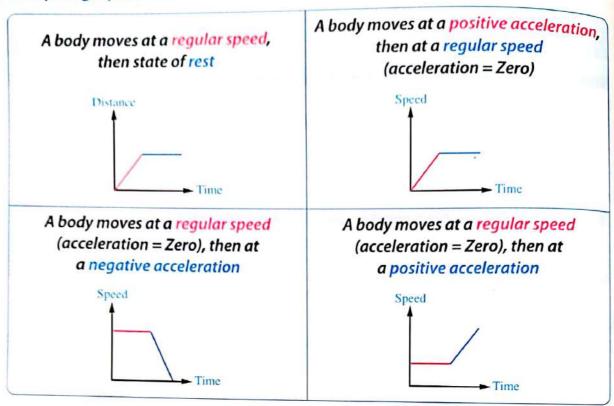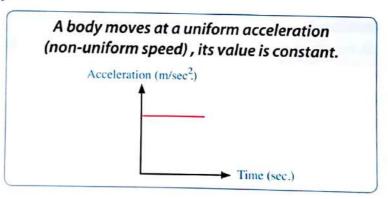
Simple graphic relations :

Body condition	A body at rest (V = 0)	A body moves at a regular speed (a = 0)	A body moves at an irregular speed (accelerating motion)	
(Distance - Time) graph	Distance / Time	Distance / Time	Distance / Time **Or**	Distance / Time
(Speed - Time) graph	It is represented as a straight line on the horizontal axis (time axis). Speed / Time	Speed / Time	**Positive acceleration** Speed / Time	**Negative acceleration** Speed / Time

✪ Complex graphic relations :

A body moves at a *regular speed*, then state of *rest*

Distance

Time

A body moves at a *positive acceleration*, then at a *regular speed* (acceleration = Zero)

Speed

Time

A body moves at a *regular speed* (acceleration = Zero), then at a *negative acceleration*

Speed

Time

A body moves at a *regular speed* (acceleration = Zero), then at a *positive acceleration*

Speed

Time

✪ Important graph :

A body moves at a uniform acceleration (non-uniform speed) , its value is constant.

Acceleration (m/sec^2.)

Time (sec.)

Questions
on lesson two

Interactive Exercises
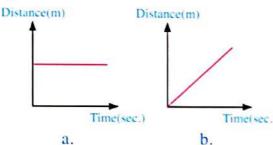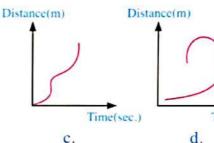
1. Choose the correct answer :
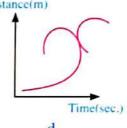
1. (Distance - Time) graph for a regular motion at a constant speed is a ....
   a. straight line parallel to time axis.
   b. straight line parallel to the distance axis.
   c. straight line passing through the origin point.
   d. straight line cuts the time axis and the distance axis.   *(Gharbia 2018 / Qena 2019)*

2. For a car moves at a regular speed, the ratio d/t ....
   a. increases.   b. is constant.   c. decreases.   d. is doubled.

3. 🔲 Which of the following graphs represents the movement of an object at a constant speed ? ....   *(Ismailia 2020)*

   a.   b.   c.   d.
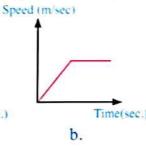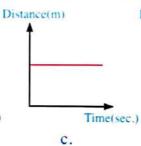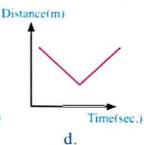
4. The graph (..........) represents an object moves with uniform acceleration.   *(Aswan 2020)*

   a.   b.   c.   d.
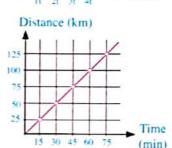
5. In the opposite graph : The ratio between the speed of two objects ($\frac{A}{B}$) approximately is ....   *(Luxor 2020)*

   a. $\frac{9}{2}$ b. $\frac{9}{4}$

   c. $\frac{3}{2}$ d. $\frac{9}{3}$

6. From the opposite graph, what is the speed of the car ? ....
   a. 25 kilometre per hour.
   b. 50 kilometre per hour.
   c. 75 kilometre per hour.
   d. 100 kilometre per hour.

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7. ▢ On recording the results of an experiment in which an object moves, the results were as follows :
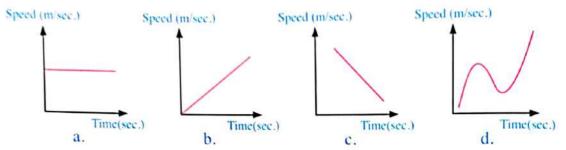
Distance (metre)	10	20	30
Time (second)	1	2	3

This object moves at ....

a. an increasing speed.

b. a uniform acceleration.

c. a uniform speed.

d. an irregular speed.

(Aswan, Red Sea 2015)

8. ▢ Which of the following (speed-time) graphs describes the movement of an object moves at a constant speed ? ....

(Red Sea, New Valley 2018)

Speed (m/sec.)	Speed (m/sec.)	Speed (m/sec.)	Speed (m/sec.)
Time(sec.)	Time(sec.)	Time(sec.)	Time(sec.)
a.	b.	c.	d.

9. If the body moves from rest at a uniform acceleration, so its final speed is determined from the relation ....

(Cairo 2016)

a. $\dfrac{V_1}{\Delta t}$

b. $\dfrac{d}{\Delta t}$

c. $\dfrac{a}{\Delta t}$

d. $a \times \Delta t$

10. The uniform acceleration means that the object speed .... by equal values through equal periods of time.

a. increases only

b. decreases only

c. increases or decreases

d. doesn't change

(Sharkia 2018)

11. When an object speed increases, the movement is described as ....

(Damietta 2017)

a. uniform speed.

b. decelerating motion.

c. zero acceleration.

d. accelerating motion.

12. When an object moves with acceleration = zero, this means : the ....

a. object's speed is changed.

b. object moves with positive acceleration.

c. object moves with deceleration.

d. object's speed is constant.
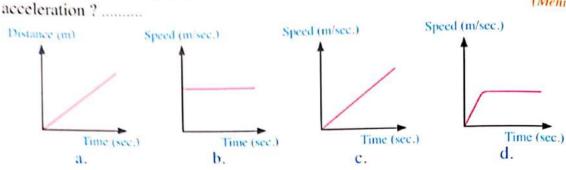
(Sohag, Gharbia 2020)

13. Decelerating motion means the ....

a. object speed decreases by time.

b. object speed increases by time.

c. object speed is constant.

d. object is at rest.

14. ▢ Acceleration is the ....

a. change in distance in a unit time.

b. change in speed in a unit time.

c. rate of change of distance relative to the speed.

d. no correct answer.

15. 📖 Acceleration measurement unit is .... *(Suez, Red Sea 2018)*

    a. metre/sec.   b. metre.sec.   c. metre/sec^2 d. metre.sec^2

16. 📖 The object moves at a constant uniform speed, this means that .... *(Sharkia 2018)*

    a. it moves at zero acceleration.

    b. it moves at constant acceleration.

    c. it covers equal distances at unequal time intervals.

    d. it covers unequal distances at equal time intervals.

17. A car moves at a speed 30 m/sec., then its speed changes to 60 m/sec. after three seconds, so the acceleration at which the car moves is ....

    a. 10 m/sec.   b. 10 m/sec^2 c. 20 m/sec^2 d. 30 m/sec.

18. If an object at rest constancy moves regularly until its speed reaches 12 m/sec. after three seconds from starting motion so, the acceleration equals .... m/sec^2 *(Behira 2014)*

    a. 36   b. $\frac{1}{4}$ c. 4   d. 9

19. If a boat starts to move from rest till its speed becomes 2.5 m/sec. through 0.5 sec. so, the acceleration of the moving boat is .... *(North Sinai 2016)*

    a. 25 m/sec^2 b. 5 m/sec^2 c. 0.2 m/sec^2 d. 10 m/sec^2

20. The ratio between the final speed and the initial speed of an object moves at an accelerating motion is .... *(Beni Suef, El-Menofia 2019)*

    a. more than one.   b. less than one.   c. equal to one.   d. equal to zero.

21. The ratio between the final speed and the initial speed of an object moving in a straight line in a decelerating motion (a negative acceleration) is .... *(Matrouh 2018)*

    a. more than one.   b. less than one.   c. equal to one.   d. equal to zero.

22. When the final speed of a moving object is less than its initial speed, therefore the object motion is described as ....

    a. uniform speed.   b. accelerating motion.

    c. decelerating motion.   d. uniform acceleration.

23. 📖 Movement is at a uniform acceleration ....

    a. if the object's speed changes at equal values in equal time intervals.

    b. if the distance that the object covers changes at equal values in equal time intervals.

    c. if the average speed equals the regular speed.

    d. no correct answer.

24. When a car moves by positive uniform acceleration of (6 m/sec^2) this means : ....

    a. The car speed increases by the rate of (6 m/sec) every second.

    b. The car speed decreases by the rate of (6 m/sec) every second.

    c. The car covers 6 meters each second.

    d. The car acceleration increases by the rate of (6 m/sec^2) every second. *(Menofia 2020)*

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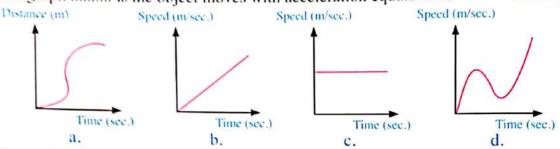
25. Which of the following graphs represents the motion of a body at a uniform acceleration ? .... *(Menia 2016)*

a.　　　b.　　　c.　　　d.
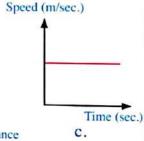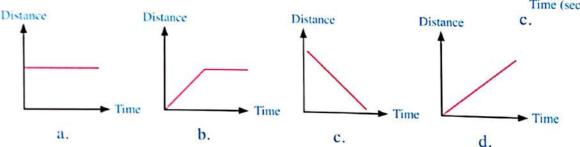
26. The graph .... is the object moves with acceleration equals zero. *(Red Sea 2019)*

a.　　　b.　　　c.　　　d.

27. A car takes 4 sec. to reach 9 times its initial speed, so the car moves with acceleration which its numeric value equals .... of initial speed. *(Luxor 2020)*

a. quarter　　　b. half　　　c. three times　　　d. double

28. The opposite graph represents the relation (speed – time) of a moving object. Which of the following graphs represents the relation (distance – time) of the same moving object ....

a.　　　b.　　　c.　　　d.

(Beni Suef 2020)

2. Correct the underlined words :
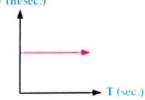
1. To understand many of the physical phenomena, use <u>acceleration</u> between different variables to describe a specific phenomenon.
(Sohag 2018)

2. The (distance - time) graph of an object moves at a regular speed is represented by a straight line <u>parallel to the (Y) axis.</u>
(Sohag 2019)

3. The distance covered by a body moving at a regular speed is <u>inversely</u> proportional to time needed to cover this distance.

4. The (speed - time) graph of a moving object at a regular speed is represented by a straight line <u>passes by the origin point.</u>
(Luxor 2015)

5. The following graph represent a body at rest. *(North Sinai 2020)*

V (m/sec.)

T (sec.)

6. Acceleration measuring unit is sec² /m.
7. The car which begins its movement from rest, moves at uniform speed. *(Alex. 2019)*
8. When a moving object covers equal distances in equal periods of time, it is said that it is moving at a decreasing acceleration. *(Suez 2017 / Luxor 2019)*
9. Displacement is the value of the change of an object speed in one second. *(South Sinai 2019)*
10. Acceleration is constant if the object's speed increases by time. *(New Valley 2018)*
11. Acceleration (a) = $\dfrac{\text{Initial speed} - \text{Final speed}}{\text{Time } (\Delta t)}$
12. When a body moves at an acceleration – 3 m/sec², this means that its initial speed is less than its final speed. *(Sharkia 2016)*
13. When a boat starts to move from rest till its speed becomes 2.5 m/sec. through 5 sec., this means that it moves with acceleration 10 m/sec². *(Ismailia 2017)*
14. The results in the table in front of you represent the experiment of a moving object at decreasing speed.

Distance (m)	10	20	30	40
Time (sec.)	1	2	3	4

15. When an object moves at uniform acceleration, this means that the speed is zero. *(Behira 2020)*

16. When the driver of a moving car uses the brake to stop it after a period of time, its initial speed becomes equal to zero. *(Cairo 2017)*

3. Write the scientific term of each of the following :

1. Mathematical methods that physicists use to predict the relation between certain physical quantities. *(Fayoum 2018 / Beni Suef 2019)*
2. • The value (amount) of change in the object speed in one second. *(Cairo 2020)*
   • The rate of change of speed.
3. The measuring unit of acceleration.
4. The change of the object speed by equal values (increases - decreases) through equal periods of time. *(Cairo 2019)*
5. • The acceleration by which an object moves when its initial speed is greater than its final speed.
   • The acceleration by which an object moves in a straight line when its speed decreases by equal values through equal periods of time.
   • The acceleration by which an object moves when its speed decreases as time passes. *(Ismailia 2018)*
6. The acceleration by which an object moves in a straight line when its speed increases by equal values through equal periods of time.
7. The acceleration by which an object moves when its final speed is less than its initial speed. *(Behira 2020)*

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4. Complete the following statements :

1. Physicists use mathematical relations like .... and .... to predict the relation between certain physical quantities. *(Sharkia 2019)*

2. The (distance - time) graph of an object moves at a uniform speed is represented by a .... line passing through the .... point. *(Qena 2016)*

3. At regular motion, the distance is .... proportional to ....

4. The (speed - time) graph of an object moves at a uniform speed is represented by a .... line parallel to the .... axis. *(Beni Suef 2018)*

5. The opposite graph shows the relation between the speed and time of a car that moves at .... speed.

   (Gharbia 2016)

   Speed (m/sec.) — Time (sec.)

6. The measuring unit of speed is .... , while the measuring unit of acceleration is .... *(Fayoum 2017, 2019)*

7. When the car speed increases, the movement is described as .... motion, while when the car speed decreases, the movement is described as .... motion.

8. If the body moves from rest, so its initial speed equals .... *(North Sinai 2018)*

9. The change in the speed of the body per unit time is called .... *(Port Said 2015)*

10. Acceleration (a) = $\dfrac{\text{..........}}{\text{Time } (\Delta t)}$

11. When an object moves at accelerating motion (increasing acceleration), this means that its .... speed is more than its .... speed. *(Luxor 2018)*

12. When an object moves at decelerating motion, this means that its initial speed is .... than its final speed. *(Ismailia 2016)*

13. The acceleration of an object is positive if its speed .... as time passes. *(Gharbia 2018)*

14. The increasing uniform acceleration means that the speed of the body changes by .... values through .... *(Dakahlia 2018)*

15. The graph of an object moving at a regular acceleration is represented by .... on the vertical axis and .... on the horizontal axis.

16. A car moves with speed 100 m/sec. If the driver used the brakes to decrease the speed, so it decreases by 4 m/sec^2, so the speed after 20 seconds from using the brakes is .... *(Menia 2016)*

17. If an object moves from rest regularly until its speed reaches 12 m/sec. after two seconds from the start of moving, so :
    (a) The change of speed through two seconds = ... m/sec.
    (b) Acceleration = ... m/sec^2
    (North Sinai 2018 / Beni Suef 2019)

18. An object starts its motion from rest till its acceleration reaches 2 m/sec^2 after 2 sec., the final speed by which it moves equals .... m/sec. *(Ismailia 2018)*

5. Give reasons for :

1. Physicists use mathematical relations like graphs and tables in many physical phenomena. *(Port Said 2020)*

2. (Distance - Time) graph of an object that moves at a uniform speed is a straight line passing through the origin point. *(Sharkia 2019 / Luxor 2020)*

3. The ratio d/t remains constant in case of a body that moves at a uniform speed.

4. (Speed - Time) graph of an object that moves at a regular speed is a straight line parallel to the time axis.

5. When the driver of a moving car uses the brakes, we describe the car movement as a decelerating motion.

6. The body which moves at acceleration can't move at a regular speed. *(Giza 2019 / Damietta 2020)*

7. The acceleration is positive when its value increases, while it is negative when its value decreases.

8. • The object which moves at a uniform speed, its acceleration equals zero. *(Menofia 2020)*
   • A body moves at zero acceleration. *(Dakahlia 2019)*

6. What is meant by ... ?

1. The ratio d/t of a moving body is constant.

2. The slope of the straight line in graphic relationship (distance-time) of a moving body equals 30 *(Damietta 2011)*

3. The change in the object speed per a unit time equals 100 m/sec^2.

4. A body moves at a uniform acceleration equals 3 m/sec^2. *(Ismailia 2018)*

5. A body moves by deceleration equals 2 m/sec^2. *(Qena 2018)*

6. A body moves at acceleration equals – 3 m/sec^2. *(Cairo, South Sinai 2017)*

7. A car moves at 20 m/sec. and after 5 seconds, its speed becomes 15 m/sec. *(Dakahlia 2016)*

8. A body moves at zero acceleration. *(Behira 2018)*

7. Define each of the following :

1. Acceleration. *(Sohag 2018)*

2. Uniform acceleration. *(Cairo 2018)*

3. Positive acceleration. *(Sharkia 2011)*

4. Negative acceleration. *(Beni Suef 2011)*

8. What happens when ... ?

1. A body moves at a uniform speed (according to the acceleration). *(Giza 2020)*

2. The object's speed changes by equal values through equal periods of time. *(Gharbia 2018)*

3. The initial speed of a moving body is greater than the final speed. *(Gharbia, New Valley 2019)*

4. A car driver press the brake for stopping after a certain time. *(Matrouh 2017)*

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9. When do the following values equal zero ?

1. The initial speed of an object.
2. The final speed of a moving object.
3. The acceleration of a moving object.

(Aswan 2020)

10. Draw a graph that illustrates each of the following :

1. A body moves at a uniform speed. *(Kalyoubia, Ismailia 2017)*
2. A body at rest. *(Ismailia 2016)*
3. The relation (distance – time) for an object moves at a uniform speed and then it stops. *(Dakahlia 2020)*
4. A body moves at a regular speed 60 km/h.
5. A body moves at a regular acceleration 15 m/sec². } from the relation (Speed - Time)
6. A body moves at zero acceleration. *(Kalyoubia 2017)*
7. A body moves at a decreasing acceleration.
8. A body moves at an increasing acceleration. *(Suez, Menofia 2017)*

11. Compare between :

1. Speed and acceleration (according to definition and measuring unit). *(Gharbia 2018)*
2. Uniform speed and uniform acceleration (according to definition).
3. • Positive acceleration and negative acceleration (according to definition). *(Damietta 2020)*
   • Acceleration and deceleration (according to definition). *(Damietta 2019)*

12. Mention the importance of graphs and tables. *(South Sinai 2018)*
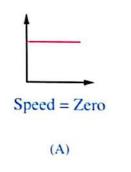
13. If a body starts to move from rest at a uniform acceleration which can be calculated from the relation : (acceleration) $a = \dfrac{10}{T \text{ (time)}}$ find :

1. The final speed of the body.
2. The type of the acceleration of the moving body. *(Kalyoubia 2014)*
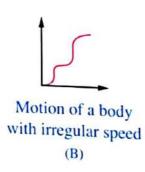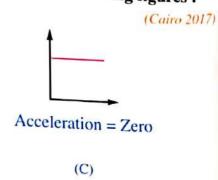
14. Study the following graphs, then answer : *(Gharbia 2012 / Sharkia 2017)*
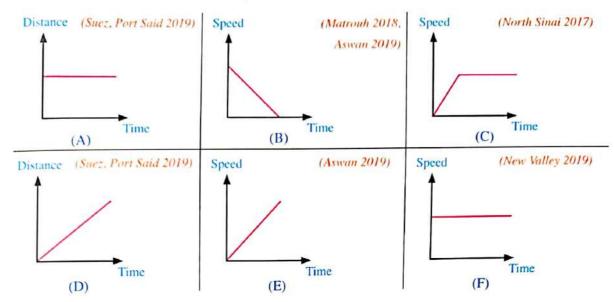
1. **What is the horizontal axis and the vertical axis represent the following figures :**

(Cairo 2017)

Speed = Zero

(A)

Motion of a body with irregular speed

(B)

Acceleration = Zero

(C)

2. **Describe the motion of the body in each of the following graphs :**

(A) *(Suez, Port Said 2019)* — Distance / Time

(B) *(Matrouh 2018, Aswan 2019)* — Speed / Time

(C) *(North Sinai 2017)* — Speed / Time

(D) *(Suez, Port Said 2019)* — Distance / Time

(E) *(Aswan 2019)* — Speed / Time

(F) *(New Valley 2019)* — Speed / Time
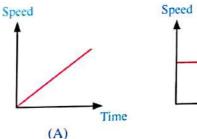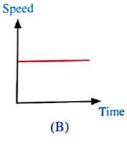
3. **Which of the following graphs represents the movement of an object at :** *(Suez 2018)*
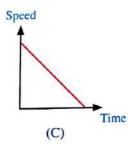
   (1) An increasing acceleration.

   (2) A decreasing acceleration.
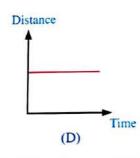
   (3) A zero acceleration.

   (4) Rest.

(A) Speed / Time

(B) Speed / Time

(C) Speed / Time

(D) Distance / Time
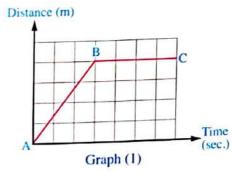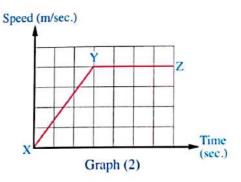
4. **From the two following graphs determine :** *(Ismailia 2016 / Damietta 2017)*

Graph (1) — Distance (m) / Time (sec.)

Graph (2) — Speed (m/sec.) / Time (sec.)

(1) The time intervals during which the body moves at a uniform speed in the two graphs.

(2) The time interval during which the body moves at a uniform acceleration.

(3) The time interval during which the body is at rest.

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15. Problems :

1. Calculate the acceleration of a moving car whose speed changes from 6 m/sec. to 12 m/sec. during 3 sec. *(Fayoum 2020)*

2. **A train moves from rest and its speed reaches 36 m/sec. in 9 seconds.** *(Cairo 2020)*
   (a) Calculate the acceleration.
   (b) What's the type of acceleration ?

3. 📖 A special car can move from rest and its speed reaches 90 m/sec. in 10 seconds. What is the acceleration at which the car moved ? *(Ismailia 2020)*

4. **On a straight line there is a moving bus whose speed changes from 6 m/sec. to 12 m/sec. during a period of 3 seconds.** *(Gharbia, Fayoum 2018)*
   (a) What is the amount of acceleration ?
   (b) What is its type ?

5. An object started its movement from rest and its speed changed into 36 km/h. in 10 seconds, calculate the object acceleration and state its type. *(Sharkia, South Sinai 2017)*

6. A car moves at a speed of 54 km/h then the driver used the brakes to decrease its speed to 36 km/h in two seconds. Calculate the time needed to stop the car from the moment of using the brakes. **[knowing that the car moves at uniform acceleration].** *(Luxor 2017)*

7. A car moves at a speed 72 km/h, the driver uses the brakes, the car stops after 8 seconds, calculate the acceleration at which the car moves. *(Ismailia 2016)*

8. A car moved from rest and its speed increased to 10 m/sec in 4 seconds, then the car's speed decreased to 5 m/sec in 2 seconds. *(New Valley 2020)*
   Calculate :
   (1) The acceleration with which the car moved during :
       (a) the first period.
       (b) the second period.
   (2) The time needed to stop the car if it moved in the same rate of change in speed in the second period.

9. A car moves at a speed of 40 m/sec. If the driver used the brakes to decrease the speed, so it decreases by 2 m/sec^2. Calculate its speed after 15 seconds from using the brakes. *(Dakahlia 2019)*

10. A car moves at a speed 50 m/sec. If the driver used the brakes to decrease the speed, so it decreases by 2 m/sec^2. Calculate its speed after 12 seconds from using the brakes. *(Qena, Aswan, Port Said 2020)*

11. A train moves at a uniform speed of 20 m/sec. When the driver uses the brakes, the train stops after 4 sec. Calculate the acceleration by which the train moves and mention the type of acceleration. *(Dakahlia 2013)*

12. A train moves at a speed of 40 m/sec. at a uniform deceleration 2 m/sec^2. If the brake is applied. Find the time taken to stop the train. *(Gharbia 2020)*

13. Calculate the time required for moving an object at acceleration 4 m/sec^2, knowing that the change in the speed equals 28 m/sec.

14. A race car can move from rest position and its speed reaches 100 km/h through 20 seconds. Calculate the acceleration of the car. *(Suez, Alexandria 2017)*

15. **If a boat starts to move from rest till its speed becomes 2.5 m/sec. through 5 sec., find :**
    (a) The acceleration of the moving boat.
    (b) The type of the acceleration. (Give a reason). *(Kafr El-Sheikh 2016 / Menia 2017)*

16. A car moves at a speed 60 m/sec. and when the driver uses the brakes to decrease the speed, so it decreases to 30 m/sec. through 15 sec.
    Calculate the time required to stop the car from the moment of using the brakes.

17. 📖 Within 2.5 seconds, the speed of a car increases from 20 m/sec. to 25 m/sec., while a bike moves from rest and its speed reaches 5 m/sec. in the same time. Calculate : *(Sohag 2017)*
    (a) The acceleration of the car and the acceleration of the bike.
    (b) Which one moves at a greater acceleration ?

18. A bike started movement from rest and its speed reached 5 m/sec. in 2.5 seconds, at the same time the speed of a car changed from 20 m/sec. to 45 m/sec., calculate their acceleration, then mention the type of acceleration. *(Alex. 2018)*

19. A Cheetah runs towards a deer at rest at a speed of 27 m/sec. till catches it after 10 seconds. Calculate the acceleration by which the Cheetah moves.

    (Menofia 2018)

20. An object starts to move from rest at an acceleration equals 4 m/sec². through 6 sec. Find the final speed of the object.

21. Within 2.5 seconds, the speed of a car increases from 60 m/sec. to 65 m/sec., while a bike moves from rest and its speed reaches 5 m/sec. in one second.
    Which of them moved at a greater acceleration ? *(Cairo 2017)*

22. A driver used the brakes to stop the car moved at a speed of 20 m/sec., calculate the time taken by the car to stop. Given that the acceleration of the car equals -1 m/sec².

    (Giza 2012)

23. **An object starts its motion from rest with regular acceleration, which calculated from the relation (a = $\frac{10}{t}$).** *(South Sinai 2020)*
    (a) Find the final speed of the object.
    (b) Mention the type of regular acceleration.

24. **If a body starts to move from rest and its speed reaches 10 m/sec. after 2 sec. from the beginning of motion. Calculate :**
    (a) Acceleration of the body.
    (b) The body speed after 5 sec. from the beginning of motion.
    (c) The time taken by the body to reach its speed 40 m/sec.

25. A car moves at a regular speed takes 5 seconds to cover 100 metres, then the driver applies on the brake so, it takes two seconds to stop after 20 metres.

(a) What is the value of acceleration at which the car moves during the first hundred metres ?

(b) Calculate the acceleration at which the car moves during the second twenty metres.

(c) What is the type of acceleration at which the car moves in the second case ?

(Kalyoubia 2016)

26. A car moves at a uniform speed covers 80 m in 4 sec. then the driver presses the brakes, so it stopped after another 4 sec. Find :

(a) The magnitude of the acceleration within the first 80 m.

(b) The magnitude of the acceleration after pressing the brakes. *(Sharkia 2020)*

27. An object moves with a uniform acceleration through 15 sec., where its speed reaches 72 km/h after 5 seconds then after the other 10 seconds, its speed reaches 54 km/h :

(a) Calculate the acceleration of the moving object.

(b) What is the type of acceleration ?

(c) Calculate the initial speed of this object. *(Luxor 2018)*
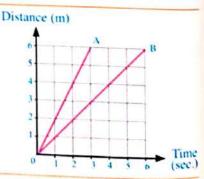
28. If the car starts to move from rest and after one second its speed becomes 2 m/sec., after another second its speed increases to 5 m/sec., then the driver had to use the brakes to slow down the car speed to 1 m/sec. in the third second, and it stops completely after another second.

Represent the relation (speed - time) graphically. *(Sharkia, Fayoum 2018)*
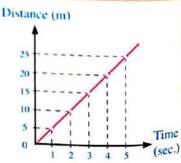
29. Two cars start their movement on an inclined road at the same moment, the first car rises up the inclined road with regular speed equal 30 m/sec., and the second car moves down the inclined road with initial speed equal 10 m/sec., and uniform acceleration of 5 m / sec². if the two cars meet each other after 5 seconds passes from that moment, find the relative speed of the first car that is observed by the driver of the second car when meeting of the two cars.

(Kalyoubia 2020)

30. **The opposite graph represents the (distance - time) graph of the movement of two bodies (A) & (B).**

(a) What is the kind of speed of the two bodies ?

(b) Calculate the ratio between the speed of body (A) and that of body (B).

(Behira 2019 / Assuit 2020)

31. **An object moves according to the opposite graph. From the graph illustrate :** *(Fayoum 2019)*

(a) The distance covered by the object after 4 seconds.

(b) The time in which the object covers a distance = 15 m

(c) The speed of the object and the type of that speed.

32. The opposite table represents the relation between distance, time and speed of an object moves at a uniform speed.

Speed (m/sec.)	Time (sec.)	Distance (m)
100	.....(1).....	50
.....(2).....	2	.....(3).....

(a) Complete the missing parts in the table.

(b) What is the value of acceleration at which the object moves ?

(Kalyoubia 2015 / Menofia 2017)

33. The distance covered by a moving object through different times are recorded in the opposite table. *(Sharkia 2020)*

(a) Represent the relation graphically.

(b) Calculate the object speed.

The distance (m)	10	20	30	40	50	60
The time (sec.)	5	10	15	20	25	30

34. The opposite table shows the results of an experiment of a car that starts moving from rest.

(a) Draw the graph which represents this relationship.

(b) Does the car move at regular speed ? Why ?

(c) Calculate the speed of this car.

(d) Find the acceleration of this car.

Distance (m)	5	10	15	20
Time (sec.)	1	2	3	4

35. A body moves in a straight line and the distances covered in different times are recorded in the opposite table :

(a) Represent the relation graphically.

(b) Calculate the body speed.

The distance (m)	0	3	6	9	12	15
The time (sec.)	0	1	2	3	4	5

(Assiut 2018)

36. The distance that is covered by a moving body through different times is recorded in the opposite table. *(Assiut 2015)*

(a) Represent the relation graphically.

(b) Calculate the speed from the graph.

The distance (m)	4	8	12	16	20
The time (sec.)	2	4	6	8	10

37. The speed that is covered by a moving body through different times is recorded in the opposite table :

(a) Represent the relation graphically.

(b) Calculate the acceleration from the table.

The speed (m/sec.)	0	10	20	30	40	50
The time (sec.)	0	5	10	15	20	25

(Assiut 2017)
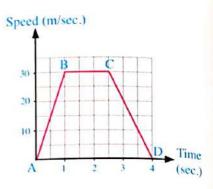
38. The opposite table shows the relation between the speed of a moving body and the time taken :

(a) Draw the graphical relation between (V) on Y-axis and (T) on X-axis.

The speed (m/sec.)	5	10	20	30	35	40
Time (sec.)	1	2	4	6	7	8

(b) From the graph find : 1. The speed of the body after a time of 5 sec.

2. The acceleration of the body. *(Behira 2018)*

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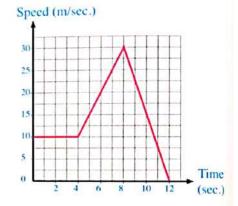
39. The opposite graph represents the motion of a train, answer the following questions : *(Alex. 2020)*

(a) What is the maximum speed of the train ?

(b) Mention the kind of motion in part (BC).

(c) When does the driver start to use the brakes ?

(d) Which part represents :

    1. Accelerating motion.

    2. Decelerating motion.
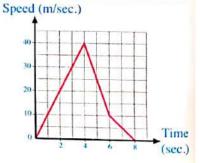
40. The opposite chart shows the contrast how to change the speed of the body for a time. **Calculate :** *(Luxor 2013)*

(a) The distance covered by the body during the first four seconds.

(b) The maximum speed reached by the body during its movement.

(c) Acceleration at which the body moves in the last four seconds. What is its kind?
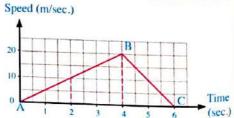
41. The opposite graph illustrates the movement of a car, study it and answer the following :

(a) The driver used the brakes for the first time at the .... second when the speed value was .... m/sec.

(b) Calculate the acceleration of the car through 4 seconds from the starting point. *(Alex. 2019)*

42. The opposite graph shows a car moves in a straight line through two intervals of time (AB) & (BC) : *(Behira 2016)*
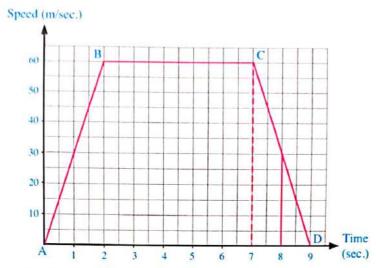
(a) Calculate the acceleration for (AB) & (BC).

(b) Mention the kind of acceleration for (AB) & (BC).

43. **Look at the opposite diagram which represents the motion of a train from (A ──→ B ──→ C ──→ D), then answer :** *(Suez 2016)*

(a) Mention the kind of motion in the part (BC).

(b) Calculate the acceleration at which the train moves in the last 2 seconds (part CD), and mention the kind of the acceleration.
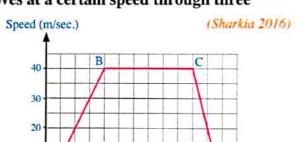
44. **The opposite graph shows a body that moves at a certain speed through three intervals of time (AB), (BC) and (CD).** *(Sharkia 2016)*

From the graph determine :
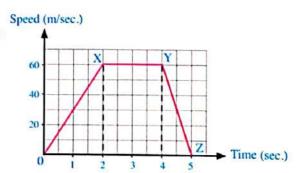
(a) The time interval during which the body moves at a uniform speed.

(b) What is the value of acceleration of the moving body at interval of time (AB) and (CD).

45. **The opposite graph represents the motion of a car. Complete :** *(Giza 2018)*
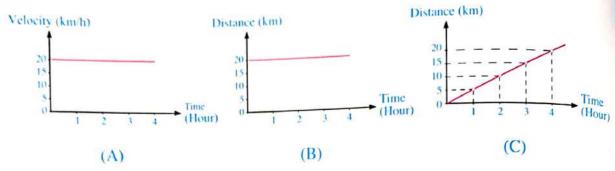
(a) The value of the maximum speed of the car equals .... m/sec.

(b) The kind of acceleration in part (YZ) is ....

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46. Three cars (A , B , C) their motion are represented by the following graphs, Study the graphs then answer :

(A) (B) (C)

(a) 1. The speed of car (A) equals (   ) km/h

2. The speed of car (B) equals (   ) km/h

3. The speed of car (C) equals (   ) km/h

(b) The relative speed of car (A) to an observer in car (C) when :

1. Both cars (A and C) move in the same direction equals (   ) km/h

2. Both cars (A and C) move in opposite direction equals (   ) km/h
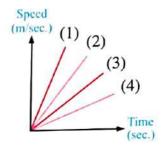
Timss Questions

1. In the opposite figure :

The line .... represents the motion at the greatest uniform acceleration [positive acceleration].

a. (1)   b. (2)

c. (3)   d. (4)

Speed (m/sec.) (1) (2) (3) (4) Time (sec.)

2. What is meant by ... ?
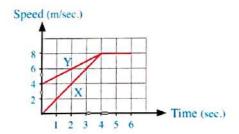
The inclined of the straight line in the graphical relation [distance - time] equals 20 m/sec.

3. When are the following amounts equal ?

(a) Change in the speed of an object with the time of such change.

(b) Acceleration at which the object moves with the amount of the change of its speed.

4. The opposite graph represents the movement of two objects (X) and (Y) :

(a) Which of them starts its motion from rest ?

(b) Which of them moves at a greater acceleration ?

(c) When do the two objects start moving at a regular speed ? And what is its value ?

Speed (m/sec.) ... Time (sec.)

5. The opposite figure shows the relation between the distance and time for a moving object in a straight line :
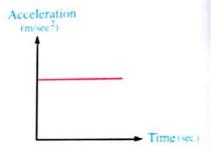
Distance (m)	10	20	30	40	50
Time (sec.)	5	10	15	20	25

(a) Represent the relation (distance - time) graphically.

(b) Represent the relation (speed - time) graphically that is obtained from the values shown in the table.

(c) Calculate the distance covered by the object after 30 sec. if it keeps moving at the same speed.

6. In a race, a runner moves at a regular speed of 10 m/sec. from the start of the race to the fifth second and there was a car that moves beside him, the speed of the car increases from zero to 25 m/sec. in 5 seconds also.
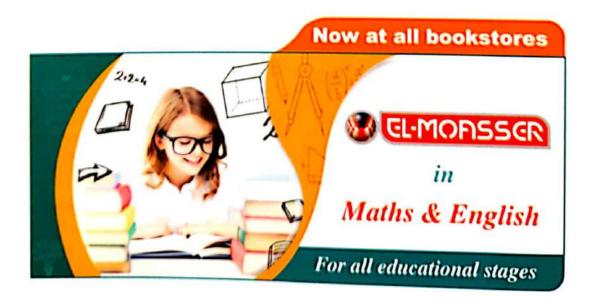
(Menia 2019)

(a) Draw a graph (speed - time) and record on it.

(1) the movement of the runner.

(2) the movement of the car.

(b) Use the previous graph to calculate :

(1) the distance covered by the runner.

(2) the time at which the speed of the runner is equal to the speed of the car.

7. Describe the motion of the object in the opposite figure.

Acceleration (m/sec²)

Time (sec.)

8. A moving bus at a constant speed travels 2000 m in 100 sec. it then stops for 50 sec. to pick up passengers, continuing its journey, the bus again moving at a constant speed travels 1000 m in the next 100 sec.

Represent the relation (distance - time) graphically.

Physical Quantities; Scalars and Vectors

What are the types of physical quantities ?
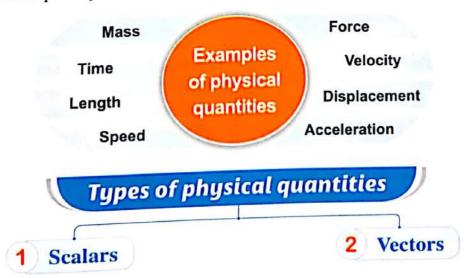
- To understand the physical phenomena (which represent the greatest part of physics),
- It is necessary to deal with physical quantities and mathematical relationships.

Physical quantity :

It is any quantity that can be determined and has a measuring unit in our life.

• Each physical quantity is measured in a special measuring unit.

Mass

Time

Length

Speed

Examples of physical quantities

Force

Velocity

Displacement

Acceleration

Types of physical quantities

1 Scalars

2 Vectors

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Types of physical quantities

1

Scalar physical quantities

2

Vector physical quantities

To describe a scalar physical quantity, it is enough to know its **magnitude only** (numeric value and measuring unit).

To describe a vector physical quantity, it is necessary to know its **magnitude** (its numeric value and measuring unit) and also its **direction**.

Scalar physical quantity

It is the physical quantity that has magnitude only and has no direction.

Vector physical quantity

It is the physical quantity that has magnitude and direction.

(Examples :)

Mass
measuring unit : **Kilogram** (kg).

Force
measuring unit : **Newton.**

Time
measuring unit : **Second** or **Hour**.

Velocity
measuring unit : **m/sec.** or **km/h.**

Length or Distance
measuring unit : **Metre** (m).

Displacement
measuring unit : **Metre** (m).

Speed
measuring unit : **m/sec.** or **km/h.**

Acceleration
measuring unit : $\mathbf{m/sec^2}$ or $\mathbf{km/h^2}$.

GR

Length and time are scalar physical quantities.

Because they have magnitude only and have no direction.

Acceleration and force are vector physical quantities.

Because they have magnitude and direction.

▶ **Enrichment information**

• *All scalars are subject to algebraic mathematical operations related to numbers*

So, they are added and subtracted if they have the same measurement units.

• *All vectors are subject to mathematical operations called vectors algebra.*

• *Vectors have great importance in different fields of physics, applied sciences like engineering. Understanding various physical phenomena such as gravity, movement of liquids and geometrical establishments depends basically on the main properties of vectors.*

NB The radius, area and density are other examples of scalar physical quantities.

The difference between some similar physical quantities

* There are some physical quantities that seem at first sight to be similar, but they have a great difference in their concept such as :

First : Distance and displacement.   **Second :** Speed and velocity.
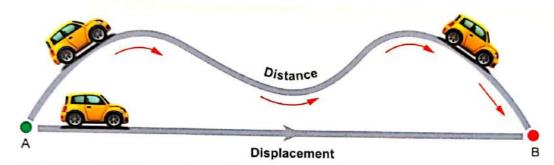
FIRST Distance and displacement

To understand the difference between distance and displacement, study the following examples :

Example 1

When a car moves from position (A) to position (B) as shown in the previous figure :

- The length of the curved line gives the *distance* covered by the car.

- The straight line that starts from point (A) and ends at point (B) in the direction $\overrightarrow{AB}$ gives the *displacement* of the car. (The shortest length between (A) and (B) in direction $\overrightarrow{AB}$) [in the Eastward direction].

Remember
North
Northern west
Northern east
West
East
Southern west
Southern east
South

Example 2

- *A person wants to make a trip by his car from Cairo (starting point) to Tanta (end point).*

- *The distance of the trip depends on the path that the car takes (it may take place in two ways as shown in the figure).*

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If the trip path is
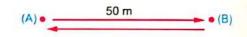
① (Cairo → Benha → Tanta)	② (Cairo → Zagazig → Tanta)
The distance covered = 45 + 60 = 105 km. "Scalar quantity".	The distance covered = 80 + 85 = 165 km. "Scalar quantity".

- You notice the difference in the distance between Cairo and Tanta (although the two cities remain constant), this difference in distance depends on the trip path.
- The **shortest straight line** that starts from Cairo and ends at Tanta represents the **displacement** of Tanta from Cairo which does not change.

i.e. The displacement = 93 km in the Northern west direction "Vector quantity".

Example 3

- *When a body moves in a straight line from (A) to (B) covering 50 metres, then it returns back to (A).*

(A) ● ←————— 50 m —————→ ● (B)

Therefore :
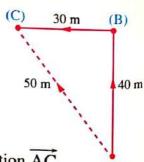
- The distance covered from (A) to (B) then to (A) = 50 + 50 = 100 m.
- The displacement from (A) to (B) then to (A) = Zero, because the body returns back to its starting point (A).

i.e. The distance = The displacement (numerically) when the body moves in a straight line in one direction, this means that :

- The distance covered from (A) to (B) = **50 m.**
- The displacement from (A) to (B) = **50 m** in direction $\overrightarrow{AB}$.

Example 4

- *When a car moves from a starting point (A) to the point (B), then to the end point (C) as shown in the opposite figure.*

Therefore :

- The **distance** covered by the car from point (A) to reach point (C)
  = AB + BC = 40 + 30 = 70 m.

- The **displacement** from point (A) to point (C) = 50 m in the direction $\overrightarrow{AC}$. (in the Northern west direction).

✏️ Note

The vector quantity **[50 m in the Northern west]** is known as **displacement** and its value **[50 m]** is known as the **amount of displacement**.

❋ **From the previous examples, we conclude that :**

Distance (d)

Distance

It is the actual length of the path that a moving object covers from the starting point to the ending point.

Displacement ($\vec{d}$)

Displacement

It is the distance covered at a certain direction from the primary position of movement towards its final position.

Amount of displacement

It is the length of the shortest straight line between two positions (primary position and final position).

What is meant by... ❓

The distance covered by an object equals 30 km.

➲ This means that the actual length of the path that a moving object covers from the starting point to the ending point equals 30 km.

Distance is a scalar physical quantity. Because it is identified by magnitude only.

The displacement of an object equals 200 km in the west direction.

➲ This means that the distance covered in the west direction from the primary position of movement towards its final position equals 200 km.

Displacement is a vector physical quantity. Because it is identified by magnitude and direction.
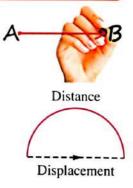
NB - The two equal displacements must have the same magnitude and the same direction.
- The direction is determined from the starting point of the movement towards the final point.

When each of the following happens ... ❓

- **The displacement happened equals the distance covered.**
  ➲ When the object moves in a straight line in one direction.

- **The amount of the displacement happened is less than the distance covered.**
  ➲ When the object moves in a curved path (or any path doesn't represent a straight line).

A——→B

Distance

Displacement

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• **The displacement of a moving object equals zero.**

➲ When the object returns to its primary position of movement, where the final position of movement is the same of its primary position.

Guidelines to solve problems on distance and displacement in a straight line :
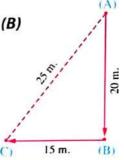
If a body moves	Figure	Distance (d)	Displacement ($\vec{d}$)
① In a straight line in one direction : (from A to B).		$\overline{AB}$ $\equiv$	$\overrightarrow{AB}$ In the east direction.
② In two opposite directions : (from A to B), then (from B to C).		$\overline{AB} \oplus \overline{BC}$	$\overrightarrow{AC} \equiv$ $\overrightarrow{AB} \ominus \overrightarrow{BC}$ In the east direction.
③ In two perpendicular directions : (from A to B), then (from B to C).		$\overline{AB} \oplus \overline{BC}$	$\overrightarrow{AC}$ In the southern east direction.
④ In three perpendicular directions : (from A to B to C to D).		$\overline{AB} \oplus \overline{BC} \oplus \overline{CD}$	$\overrightarrow{AD}$ In the south direction
⑤ In more than one direction, then returns back to the starting point : (from A, then returns back to A).		$2\,\overline{AB}$	
		$\overline{AB} \oplus \overline{BC} \oplus \overline{CA}$	Zero
		$\overline{AB} \oplus \overline{BC} \oplus \overline{CD}$ $\oplus \overline{DA}$	

Problems

1 *If a body moved from point (A) to the point (C) passing by point (B) as shown in the figure.*

Calculate :
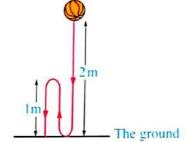
1. Distance covered by the body.

2. Displacement done by the body.

Solution

1. Distance = 20 + 15 = 35 m.

2. Displacement = 25 m in the direction $(\overrightarrow{AC})$.

2 *A rubber ball fell downward from a height equal 2 metres from the ground, then returned upward 1 metre, then fell down again to rest on the ground. Calculate :*
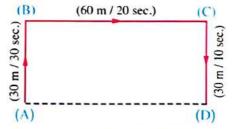
1. Distance.

2. Displacement.

Solution

1. Distance = 2 + 1 + 1 = 4 metres.

2. Displacement = 2 metres downward.

3 *A car starts motion from point (A) and covers 30 metres northward to point (B) within 30 seconds, then 60 metres eastward to point (C) within 20 seconds, and then 30 metres southward to point (D) within 10 seconds.*

Find :

1. Total distance covered by this car.

2. Total time that car took to cover this distance.

3. Displacement and what is its direction ?

Solution

1. Total distance = 30 + 60 + 30 = 120 m.

2. Total time = 30 + 20 + 10 = 60 sec.

3. Displacement = 60 m in the direction $(\overrightarrow{AD})$.

Scanned with CamScanner

Guidelines to solve problems on distance and displacement in a circular path :

If a body moves	Figure	Distance (d)	Displacement $\vec{d}$
1 In a complete circle : from (A : B : C : D : A).		The circumference of the circle = $2\pi r$ [where $(\pi) = \frac{22}{7}$, (r) = radius].	Zero
2 In a $\frac{3}{4}$ circle : from (A : B : C : D).		$\frac{3}{4}$ The circumference of the circle $= \frac{3}{4} \times 2\pi r$	$\overrightarrow{AD} = \sqrt{(AM)^2 + (DM)^2}$ In the southern east direction. (according to the Pythagorean theorem).
3 In a $\frac{1}{2}$ circle : from (A : B : C).		$\frac{1}{2}$ The circumference of the circle $= \frac{1}{2} \times 2\pi r$	The diameter $\overrightarrow{AC} = 2r$ in the east direction.
4 In a $\frac{1}{4}$ circle : from (A : B).		$\frac{1}{4}$ The circumference of the circle $= \frac{1}{4} \times 2\pi r$	$\overrightarrow{AB} = \sqrt{(AM)^2 + (BM)^2}$ In the northern east direction. (according to the Pythagorean theorem).
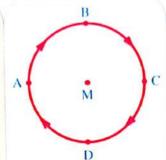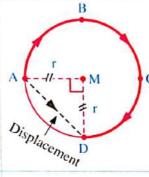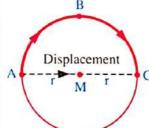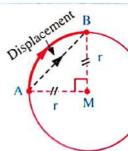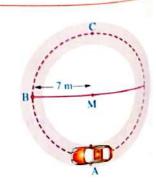
(4) *The opposite figure represents a car motion on a circular path from point (A). Calculate the distance and the displacement when the car moves in :*

1. A complete circle.
2. A $\frac{1}{2}$ circle.
3. A $\frac{1}{4}$ circle.

Solution

(1) A complete circle.

- **The distance covered (d)**
  = The circumference of the circle
  $= 2\pi r = 2 \times \frac{22}{7} \times 7 = 44$ m.

- **The displacement $(\vec{d})$** = Zero.

(2) A $\frac{1}{2}$ circle.

- **The distance covered (d)**
  $= \frac{1}{2}$ the circumference of the circle
  $= \frac{1}{2} \times 44 = 22$ m.

- **The displacement $(\vec{d}) = (\overrightarrow{AC}) = $**
  The diameter of the circle = 2 r
  $= 2 \times 7 = 14$ m in the north direction.

(3) A $\frac{1}{4}$ circle.

- **The distance covered (d)**
  $= \frac{1}{4}$ the circumference of the circle
  $= \frac{1}{4} \times 44 = 11$ m.
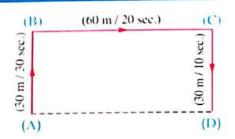
- **The displacement $(\vec{d}) = (\overrightarrow{AB})$**
  [According to the Pythagorean theorem]
  $= \sqrt{(AM)^2 + (MB)^2} = \sqrt{(7)^2 + (7)^2} = 9.9$ m
  in the northern west direction.

⮕ **Comparison between** the distance (d) and the displacement $(\vec{d})$:

Points of comparison	Distance (d)	Displacement $(\vec{d})$
1 Definition :	It is the actual length of the path that a moving object covers from the starting point to the ending point.	It is the distance covered at a certain direction from the primary position of movement towards its final position.
2 It is determined by :	Magnitude only.	Magnitude and direction.
3 Its kind :	Scalar physical quantity.	Vector physical quantity.
4 Measuring unit :	Metre or kilometre.	Metre or kilometre.

SECOND / Speed and velocity

- To know what is the difference between **speed** and **velocity**. Study the opposite figure which represents the movement of an object from the primary position (A) to the final position (D) passing by positions (B) and (C).

[The path of this object is A ⟶ B ⟶ C ⟶ D].

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We conclude that :

- Total distance covered by the object (d)

$$= \overline{AB} + \overline{BC} + \overline{CD}$$

$$= 30 + 60 + 30 = 120 \text{ m}.$$

- Total time taken by the object to cover this distance = 30 + 20 + 10 = 60 sec.

- The total distance divided by the total time is known as **the average speed** :

> Average speed (V) ⊜ $\dfrac{\text{Total distance (d)}}{\text{Total time (t)}}$

$$\overline{V} = \dfrac{d}{t} = \dfrac{120}{60} = 2 \text{ m/sec}.$$

Average speed

It is the total distance covered by the object in one second (a unit time).

- Speed can be identified by its magnitude only.

- The displacement covered by the object $(\vec{d}) = \overrightarrow{AD} = 60$ m in the eastward direction.

- Total time = 60 sec.

- The displacement divided by the total time is known as **the average velocity** :

> Average velocity ($\vec{V}$) ⊜ $\dfrac{\text{Displacement } (\vec{d})}{\text{Total time (t)}}$

$$\vec{V} = \dfrac{\vec{d}}{t} = \dfrac{60}{60} = 1 \text{ m/sec}.$$ in the eastward direction.

Average velocity

It is the displacement covered by the object in one second (a unit time).
or
It is the rate of change of displacement.

- Velocity can be identified by its magnitude and direction.

✎ Notes

- The measuring units of velocity are m/sec. or km/h [The same measuring units of speed].

- The velocity is the speed in a given direction (When the body moves in a straight line in one direction).

- Velocity is a vector physical quantity and to determine it accurately, it is necessary to identify its magnitude and direction.

Such as : When we say that the predator (Cheetah) is one of the fastest wild animals, its speed is about 27 m/sec., but if we want to represent its velocity, we say that its velocity is 27 m/sec. in a certain direction.

We can say that Cheetah's velocity = 27 m/sec. in the westward direction.

What is meant by ... ?

A body covered 50 m northward direction in 5 sec.

⊃ $\vec{V} = \dfrac{\vec{d}}{t} = \dfrac{50}{5} = 10$ m/sec. northward.
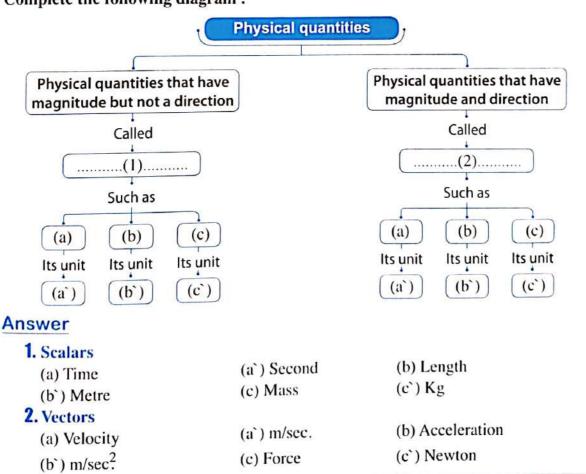
This means that the velocity of this body equals 10 m/sec. in northward direction.

⊃ Comparison between average speed and average velocity :

Points of comparison	Average speed	Average velocity
① Definition :	It is the total distance covered in a unit time.	It is the displacement covered in a unit time.
② It is determined by :	Magnitude only.	Magnitude and direction.
③ Its kind :	Scalar physical quantity.	Vector physical quantity.
④ Measuring unit :	m/sec. or km/h.	m/sec. or km/h.

? Exercise

Complete the following diagram :

```
                        Physical quantities

        Physical quantities that have          Physical quantities that have
        magnitude but not a direction          magnitude and direction
                    Called                              Called
                  ......(1)......                     ......(2)......
                    Such as                             Such as
          (a)      (b)      (c)              (a)       (b)       (c)
        Its unit  Its unit  Its unit         Its unit  Its unit  Its unit
          (a`)     (b`)     (c`)             (a`)      (b`)      (c`)
```

Answer

1. Scalars
  (a) Time   (a`) Second   (b) Length
  (b`) Metre         (c) Mass           (c`) Kg

2. Vectors
  (a) Velocity   (a`) m/sec.   (b) Acceleration
  (b`) m/sec.$^2$       (c) Force          (c`) Newton

Problems
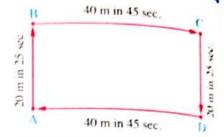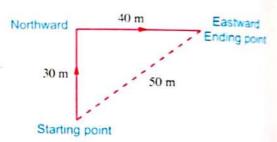
1 In the opposite figure, a person starts moving from point (A) and returns back to the start point through B, C and D. Calculate :
1. Average speed.
2. Velocity (Give a reason).

B ⟶ 40 m in 45 sec. ⟶ C
20 m in 25 sec
20 m in 25 sec
A ⟵ 40 m in 45 sec. ⟵ D

Solution
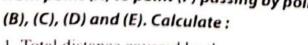
1. Average speed = $\dfrac{\text{Total distance}}{\text{Total time}}$ = $\dfrac{20 + 40 + 20 + 40}{25 + 45 + 25 + 45}$ = 0.8 m/sec.

2. Velocity = Zero.
   Because the displacement equals zero.

2 In the opposite figure, a body covered 30 metres northward within 30 seconds, then 40 metres eastward within 20 seconds and stopped at a point about 50 metres from the starting point. Calculate :
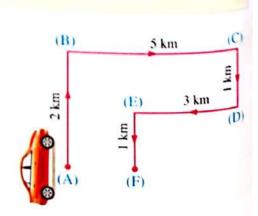
Northward   40 m   Eastward Ending point
30 m   50 m
Starting point

1. Total distance moved by the body.
2. Average speed.
3. Displacement.
4. Average velocity.

Solution

1. Total distance = 30 + 40 = 70 m.

2. Average speed = $\dfrac{\text{Total distance}}{\text{Total time}}$ = $\dfrac{30 + 40}{30 + 20}$ = 1.4 m/sec.

3. Displacement = 50 m in the northern east direction.

4. Average velocity = $\dfrac{50}{50}$ = 1 m/sec. in the northern east direction.

3 In the opposite figure, a car starts motion from point (A) to point (F) passing by points (B), (C), (D) and (E). Calculate :
1. Total distance covered by the car.
2. Displacement done by the car.
3. Velocity if you know that the total time spent by the car equals 0.033 hours.

(B) ⟶ 5 km ⟶ (C)
2 km   1 km
(E)   3 km
1 km   (D)
(A)   (F)

Solution

1. Total distance = 2 + 5 + 1 + 3 + 1 = 12 km.

2. Displacement = 5 − 3 = 2 km in eastward direction $\overrightarrow{AF}$.

3. Velocity = $\dfrac{\text{Displacement}}{\text{Total time}}$ = $\dfrac{2}{0.033}$ = 60.6 km/h. in eastward direction $\overrightarrow{AF}$.

Science, Technology and Society

* **Importance of wind velocity for flights :**

- The movement of wind arises from the difference of air pressure in different regions above the Earth's surface.

- The movement of the Earth around itself from west to east affects the direction of wind, which affects the value of velocity of the plane.

  So, Pilots take in consideration the velocity of the wind.

* **Application :** The opposite figure shows the flight path of a plane covered a fixed distance between the two cities (1) and (2) back and forth.

What happens when the plane takes off ... ?

• In the same direction of wind from city (1) northeast direction to city (2).	• In the opposite direction of wind from city (2) southwest direction to city (1).
➲ The value of its velocity increases, so the time of the trip decreases and therefore the amount of the fuel consumed decreases.	➲ The value of its velocity decreases due to the resistance of the wind to the movement of the plane, so the time of the trip increases and therefore the amount of the fuel consumed increases.
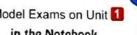
GR. *Pilots take in consideration the velocity of the wind.*

Because the direction of wind affects the velocity of the plane and hence the time of the trip and the amount of the fuel consumed.

TRY To answer worksheet
- General Exercise of the School Book on Unit **1** **6**
- Model Exams on Unit **1** in the Notebook

Remember

Physical quantities

Scalar physical quantity

It is the physical quantity that has magnitude only and has no direction.

Ex.: Mass, length, time and speed.

Vector physical quantity

It is the physical quantity that has magnitude and direction.

Ex.: Acceleration, displacement, velocity and force.

⊕ **Distance :** It is the actual length of the path that a moving object covers from the starting point to the ending point.

⊕ **Displacement :** It is the distance covered at a certain direction from the primary position of movement towards its final position.

⊕ **Amount of displacement :** It is the length of the shortest straight line between two positions [primary position and final position].

⊕ **Velocity :** - It is the rate of change of displacement.

Or

- It is the displacement covered by the object in one second (a unit time).

Questions
on lesson three

Interactive Exercises

1. Choose the correct answer :
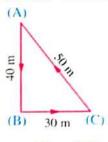
1. The scalar quantity is identified by its ....
   a. magnitude only.
   b. direction only.
   c. magnitude and direction.
   d. magnitude and velocity.

2. .... is a scalar physical quantity that is identified by magnitude only. *(Alex. 2020)*
   a. Velocity
   b. Acceleration
   c. Time
   d. Force

3. All of the following are scalar quantities except .... *(Beni Suef 2015)*
   a. length.
   b. force.
   c. time.
   d. mass.

4. To determine the length, mass and time, we must know .... *(Fayoum 2018)*
   a. the magnitude and the direction.
   b. the magnitude and the measuring unit.
   c. the direction and the measuring unit.
   d. the magnitude, the direction and the measuring unit.

5. From the examples of the scalar physical quantities are .... *(Kalyoubia 2020)*
   a. the length and the acceleration.
   b. the time and the weight.
   c. the mass and the velocity.
   d. the time and the speed.

6. Which of the following physical quantities are considered as scalars only ? ....
   a. The force and the time.
   b. The mass and the force.
   c. The radius and the area.
   d. The displacement and the acceleration.

(Port Said 2015)

7. From the examples of the scalar quantities is the .... *(Suez , Menofia 2019)*
   a. velocity.
   b. mass.
   c. force.
   d. acceleration.

8. 📖 .... is the physical quantity that both its magnitude and direction are necessary for identifying it. *(Fayoum, New Valley 2020)*
   a. The quantity of matter
   b. Scalar quantity
   c. Vector quantity
   d. No correct answer

9. Which of the following physical quantities are considered as vectors only ? ....
   a. The mass and the force.
   b. The displacement and the acceleration.
   c. The radius and the area.
   d. The force and the time. *(Giza 2020)*

10. From the examples of the vector physical quantities is .... *(Red Sea 2020)*
    a. displacement.
    b. mass.
    c. time.
    d. distance.

11. One of the vector physical quantities is .... *(Kalyoubia 2019)*

    a. time of a car trip.
        b. length of a pen.

    c. mass of a cat.
        d. force by which a person pushes a stone.

12. .... is a vector quantity measured in m/sec.

    a. Velocity
    b. Acceleration
    c. Speed
    d. Displacement

13. ⬜ Acceleration is a .... *(Kafr El Shiekh 2020)*

    a. vector quantity whose unit is m/sec^2
    b. vector quantity whose unit is m/sec.

    c. scalar quantity whose unit is m/sec^2
    d. scalar quantity whose unit is m/sec.

14. The shortest distance covered by the object in a certain direction is called ....

    a. distance.
    b. displacement.
    c. acceleration.
    d. speed.

(North Sinai 2019)

15. ⬜ Displacement is a .... *(Menofia 2017)*

    a. scalar quantity and its unit is metre.
    b. vector quantity and its unit is m/sec.

    c. vector quantity and its unit is kilogram.
    d. vector quantity and its unit is metre.

16. The distance and displacement are equal when the body moves in a .... in one direction.

    a. zigzag
    b. circular
    c. straight line
    d. curved *(Beni Suef 2019)*

17. From the opposite figure, when an object moves from point (A) to point (D) passing through points (B) and (C), the displacement from (A) to (D) equals .... in the direction $(\overrightarrow{AD})$.

    a. 20 cm.
    b. 40 cm.

    c. 60 cm.
    d. 80 cm.

18. In the opposite figure, a body starts its motion from point (A) directed to the south to point (B), it covers a distance of 40 m, then it is directed to the east to point (C) which far 30 m apart from the point (B), so : ....

    (A) The value of the body displacement equals .... *(Minia, North Sinai 2020)*

        a. the length of AB.
        b. the length of BC.

        c. the length of AC.
        d. the length of AB + BC.

    (B) The length of the distance covered equals ....

        a. the length of AB.
        b. the length of BC.

        c. the length of AC.
        d. the length of AB + BC.
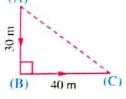
19. In the opposite figure, a body starts its motion from point (A) to (B), then to point (C), then returned to point (A), so the distance covered equals .... metre.

    a. 120

    b. 70

    c. 50

    d. zero

    (Qena 2020)

20. In the opposite figure, an object starts movement from point (A) to point (C) passing through point (B), so its displacement is .... m.

    a. 70

    b. 30

    c. 50

    d. 40

    (Beni Suef 2018)

21. A body moved a distance of 20 metres in a straight line in the same direction, so the amount of its displacement is .... *(Menia 2018)*

    a. 20 m.

    b. 40 m.

    c. 80 m.

    d. zero.

22. If a person moves 8 m to the north, then 4 m to the east, then 8 m to the south, his displacement equals .... in the east direction. *(Laxor 2013)*

    a. 20 m

    b. 4 m

    c. 8 m

    d. 12 m

23. .... is considered from the fastest wild animals.

    a. Wolf

    b. Lion

    c. Cheetah

    d. Elephant

24. ☐ Measurement unit of velocity is .... *(Matrouh 2016)*

    a. m.sec.

    b. m/sec.

    c. m.

    d. m/sec^2.

25. The average velocity is determined by the relation ....

    a. distance/time.

    b. distance × time.

    c. displacement/time.

    d. speed/time.

26. The plane which flies against the wind direction .... than that which flies in the same direction of wind.

    a. consumes more fuel
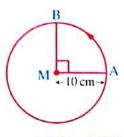
    b. takes longer time

    c. its speed increases

    d. (a) and (b) are correct

27. From the opposite figure, when an object moves from point (A) to point (B), the displacement from (A) to (B) equals .... cm.

    a. $10\sqrt{2}$

    b. 10

    c. 20

    d. 31.4

    (Behira 2018)

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2. Choose from column (B), what suits it in column (A) : *(Assiut 2011)*
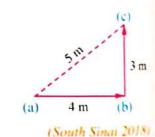
(A)	(B)
1. Distance	a. is the shortest distance covered by the object in a fixed direction.
2. Speed	b. is the distance moved through a unit time.
3. Displacement	c. is the speed of a moving object relative to the observer.
4. Relative speed	d. is the actual length of the path that a moving object takes from the start point of movement to the end point.

3. Correct the underlined words :

1. The <u>distance</u> is a vector physical quantity and its measuring unit is the metre.
   (Kalyoubia 2017)

2. The <u>length</u> is a vector quantity. *(Aswan 2014)*

3. The <u>force</u> is from scalar physical quantities. *(Port Said 2018)*

4. The <u>time</u> is a vector physical quantity. *(South Sinai 2016)*

5. The distance is a <u>vector</u> quantity and the displacement is a <u>scalar</u> quantity.

6. Mass is a <u>vector</u> physical quantity and its measuring unit is kilogram. *(Kalyoubia 2016)*

7. <u>Speed</u> is a vector physical quantity.

8. In the opposite figure an object moves eastward from point (a) to point (b) during two seconds, then to point (c) northward in 3 seconds, so its velocity through that period is <u>1.4 m/sec.</u> *(Kalyoubia 2020)*

9. Displacement is characterized by both magnitude and <u>time</u>. *(South Sinai 2018)*

10. The vector physical quantities need <u>magnitude only</u> to be determined. *(Fayoum 2014)*

11. Velocity $= \dfrac{\text{Distance}}{\text{Total time}}$ *(Aswan 2019)*

12. Velocity is the quantity that we can identify it accurately by knowing its <u>magnitude only</u>. *(Kalyoubia 2014)*

13. <u>Regular speed</u> is the value of displacement in one second. *(Cairo 2020)*

14. To determine the <u>density</u> we must know its magnitude and direction. *(Giza 2017)*

15. <u>Acceleration</u> is the actual length of the path that a moving object takes from the starting point of movement to the end point. *(Sharkia 2019 / Gharbia 2020)*

16. The value of <u>distance</u> is the length of the shortest straight line between two positions. *(Menia 2019 / Behira 2020)*

17. A person moves 40 m northward then returned 20 m southward, so his displacement is <u>60 m</u> northward. *(Qena 2019)*

18. A racer covered 50 m northward, then 10 m eastward, then 50 m southward and then returned back to the starting point, so the value of his displacement equals 300 m.

(Giza 2014)

19. When an object moves in a curved line in one direction, the covered distance is equal to the displacement.

(Beni Suef 2018)

20. The regular speed is the scalar speed, but in a given direction.

(Beni Suef 2018)

21. The displacement measurement unit is m/sec.

(Kalyoubia 2015, 2019)

22. Velocity is the rate of change of acceleration.

23. The measuring unit of velocity is sec./m.

(South Sinai 2016)

24. Lion is considered one of the fastest wild animals.

(Menia 2019)

25. Pilots take in consideration the uniform speed of the wind.

(Luxor 2019 / Ismailia 2020)

4. Write the scientific term of each of the following :

1. • The physical quantity that has magnitude only and has no direction.

(Gharbia 2018)

   • The physical quantity which magnitude is enough for identifying it.

(Ismailia 2018)

2. The physical quantities that include time, length and mass.

3. The physical quantity enough to identify it magnitude as well as direction.

(Suez 2016)

4. The physical quantity that refers to the change in the speed of an object in a unit time.

(Port Said 2016 / Beni Suef 2019)

5. The distance covered in a certain direction between the starting point and the ending point.

(Luxor 2018 / Qena 2019 / Giza 2020)

6. The vector quantity which is measured in km/h.

7. The vector physical quantity which is measured in m/sec^2

(Menofia 2018)

8. The length of the shortest straight line between primary position and final position.

(The New Valley 2017, 2019)

9. The actual length of the path that a moving object covers from the starting point to the ending point of the motion.

(New Valley 2020)

10. The rate of change of displacement.

(Behira 2014 / Matrouh 2019)

11. The displacement covered in one second.

(Minia, Qena 2020)

12. The predator wild animal that its velocity is represented by determination the direction of its motion.

(Fayoum 2015)
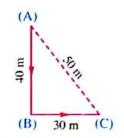
5. Complete the following statements :

1. All physical quantities are classified into two types which are .... and ....

(Qena 2014 / Alexandria 2017)

UNIT **1**
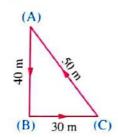
2. ☐ .... is the quantity that is characterized by the magnitude only. *(South Sinai 2018, 2019)*

3. Speed is a .... physical quantity which is measured in ....

4. Acceleration is considered one of .... physical quantities, while time is considered one of .... physical quantities. *(Sharkia, Ismailia 2020)*

5. The measuring unit of displacement is .... , while the measuring unit of acceleration is .... *(Suez 2018)*

6. ☐ .... is the quantity that its magnitude and direction are necessary for identifying it. *(Aswan 2018 / Assiut 2019)*

7. Acceleration is a .... physical quantity which is measured in .... *(Matrouh 2016)*

8. From the examples of scalar physical quantities is ...., while from the examples of vector physical quantities is .... *(Suez 2016 / Alex. 2019)*

9. .... , ... and acceleration are from the vector quantities. *(Sohag 2018)*

10. Displacement is considered .... quantity, while the density is considered .... quantity. *(Suez, Sharkia 2017)*

11. The product of the velocity of a body × the time = ... *(Sohag 2017 / Gharbia 2019)*

12. Force is considered .... physical quantity and mass is considered .... physical quantity. *(Fayoum, Ismailia 2019)*

13. Distance is a .... physical quantity, while force is a .... physical quantity. *(New Valley 2019)*

14. The length of the actual path covered by a moving body from the starting point to the ending point of motion is called .... *(Alex. 2020)*

15. The shortest distance that is covered by a body in a constant direction from start position to end position is called .... *(Fayoum 2018 / Luxor 2019)*

16. The length of the shortest straight line between two positions is called .... *(Ismailia 2018)*

17. The displacement of an object within an interval time does not depend on the path of the moving object (distance) only but it depends on .... *(New Valley 2016)*

18. .... is a scalar physical quantity which is measured in metre, while .... is a vector physical quantity which is measured in metre also.

19. Displacement equals distance, when the object moves in a .... line and in ....

20. ☐ .... is the covered distance in a constant direction and it is a vector physical quantity.

21. Distance covered by a moving body in a unit time is known as ...., while .... is the covered distance in a certain direction. *(Alex. 2015)*

22. Average velocity = $\dfrac{..........}{..........}$ *(Alex. 2018)*

23. .... is considered one of the fastest wild animals, where its speed is .... m/sec. *(Fayoum 2014)*

24. Velocity and displacement of an object are similar in ...., while for the measuring units they are .... *(Menofia 2019, Behira 2020)*

25. ☐ .... is the value of displacement at a unit time and it is a .... physical quantity.

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26. When an object moves from point (A) to point (B) in a straight line to cover a distance 60 m in 5 second, so the object speed equals ...., while its average velocity equals ....

27. In the opposite figure, a body starts its motion from

    (A) ⟶ (B) ⟶ (C)

    The value of the body displacement equals ....
    and the length of the distance covered equals ....

    (A)

    40 m · 50 m

    (B)   30 m   (C)

    (Kafr El-Sheikh 2016)

28. In the opposite figure, a body starts its motion from point (A) point (B) , then to point (C) then returned to point (A), so the displacement covered equals ....

    (A)

    40 m · 50 m

    (B)   30 m   (C)

    (Behira 2019 / Assiut 2020)

29. The plane which flies against the wind direction takes .... time and consumes more .... than that which flies in the same direction of wind due to wind ....

6. Complete the spaces in the following table :   *(South Sinai 2018)*

Time (second)	Displacement (m)	Velocity (m/sec.)
5	100	...... (1) ......
10	50	5
...... (2)	96	8

7. Give reasons for :

1. Mass, length and time are considered scalar physical quantities.   *(Sohag 2015, 2016)*

2. Force is a vector physical quantity.   *(Menofia 2019 / Suez 2020)*

3. Distance is a scalar quantity, while displacement is a vector quantity.   *(North Sinai 2020)*

4. Acceleration is a vector physical quantity.   *(Beni Suef 2015)*

5. The velocity is a vector physical quantity.   *(North Sinai 2018, 2019)*

6. When an object moves, where its starting point is the ending point, its velocity is zero.

7. The amount of consumed fuel by a plane flies between two cities differs according to the wind direction.   *(Menofia 2019 / Minia 2020)*

8. Pilots take in consideration the velocity of the wind during their flights.   *(Qalyoubia 2020)*

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8. What is meant by ... ?

1. Length is a scalar physical quantity.
2. Force is a vector physical quantity. *(Ismailia, Menofia 2017)*
3. The body moves 60 metres and the value of the displacement equals zero. *(Giza 2013)*
4. The displacement of an object is 50 metres in east direction. *(Giza 2018)*
5. Displacement equals the covered distance. *(Sharkia, Gharbia 2017)*
6. A body covered 40 m northward direction in 20 sec. *(Ismailia 2015)*
7. The distance which an object travels in the east direction equals 30 m. *(Menofia 2020)*
8. The value of the length of the shortest straight line between two positions equals 5 m. *(Kalyoubia 2019)*

9. Define each of the following :

1. 📖 The scalar physical quantity. *(Giza 2018)*
2. 📖 The vector physical quantity. *(North Sinai 2016 / Menia 2019)*
3. Distance.
4. 📖 Displacement. *(Sohag 2018)*
5. Velocity. *(Qena 2018)*

10. When the following cases occur ... ?

1. • The distance covered by a body equals the amount of displacement happened. *(Suez, Giza 2019 / Kalyoubia 2020)*
   • The amount of the speed equals the amount of the velocity.
2. The displacement of a moving body equals zero. *(Suez 2017 / Matrouh 2019)*
3. The velocity of a moving body equals zero.

11. Compare between :

1. Scalar physical quantity and vector physical quantity (according to definition - examples). *(Minia, Kafr El Shiekh 2020)*
2. Distance and displacement (according to definition-kind of the physical quantity). *(Port Said, Cairo 2019)*
3. Speed and velocity. *(Giza 2020)*
4. Mass and force (according to the kind of physical quantity). *(Menia 2018)*
5. The mathematical relation used to calculate the uniform speed and the mathematical relation used to calculate the velocity. *(Dakahlia 2018)*
6. Displacement and acceleration (according to definition only). *(Kafr El-Sheikh 2018)*

12. Which of the physical quantities are scalars and which are vectors ?

1. Displacement.
2. Mass.
3. Length.
4. Force. *(Cairo 2020)*

13. Problems :

1. A rubber ball falls from a height of 10 metres, then it rebounds from the ground to upward distance of 5 metres, then falls down to rest on the ground. *(Menia 2018)* Calculate :

   (a) The distance covered.   (b) The displacement.

2. 📖 If you move to a distance of 5 metres northward and your colleague moves to a distance of 5 metres southward, compare between : *(Port Said 2012)*

   (a) The distance that you covered and the distance that your colleague covered.

   (b) The displacement that you covered and the displacement that your colleague covered.

3. An object moves in a straight line northward at a speed of 5 m/sec. and its speed reaches 20 m/sec. through 3 seconds. Calculate the following : *(Suez 2020)*

   (a) The velocity after 3 seconds.

   (b) The acceleration of the moving object.

4. An object moves 8 m to the east then moves 5 m to the west determine. The magnitude and the direction of the object's displacement. *(Menofia 2019)*
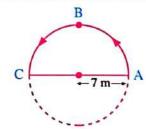
5. A body moves from point (A) to point (B), then change its direction to point (C) through 10 sec. Calculate.

   (a) Total distance which the body moved.

   (b) Displacement done by the body.

   (c) The velocity. *(Damietta 2016 / Ismailia 2019)*

   Zero 1 m 2 m 3 m 4 m
   A   C   B
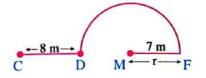
6. A car covered 600 m in eastward direction within 60 sec. Find its average velocity.

7. In the opposite figure, a body moves in a circular path, its radius = 7 m from (A) to (C) passing by point (B) within 3.5 sec. If you know that the circumference of the circle = 2 π r (where π = $\frac{22}{7}$, r = radius). Calculate :

   (a) Total distance.

   (b) Displacement.

   (c) Velocity. *(Kalyoubia 2015)*

8. In the opposite figure : An object is moving from point (C) to point (M), passing by two points (D , F) in 5 sec., Calculate :

   (a) The covered distance.

   (b) The velocity. *(Luxor 2020)*

المعاصر علوم لغات (شرح) /٣ع/ تيرم ١ (م : ١٣) **97**

9. In the opposite figure, a car moves in a circular path whose radius is 10 metres, the car movement changed as in the opposite figure if you know that the circumference of the circle = 2 πr where (π = 3.14). Calculate :

   (a) The total distance covered by the car from point (A) to point (D) passing by points (B) and (C).

   (b) Displacement.

   (Kalyoubia 2017)

10. A person covered 30 metres northward within 30 seconds, then 60 metres eastward within 20 seconds, and then 30 metres southward within 10 seconds. Calculate :
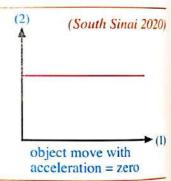
    (Sharkia 2018)

    (a) The value of the total distance.

    (b) The average velocity, then mention its direction.

11. A car moved from Benha to Cairo at a distance 40 km in 30 min., then it returns back from Cairo to Benha in the same time. Calculate in km/h :

    (a) The car velocity from the beginning to the end of the journey.

    (b) The average speed of the car during the total time. *(Kalyoubia 2019)*
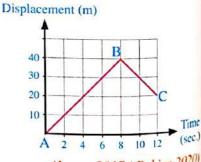
12. In the opposite graph :

    Mention the name of horizontal axis (1) and vertical axis (2).

    (South Sinai 2020)

    object move with acceleration = zero
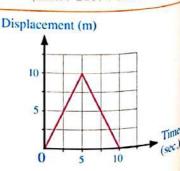
13. The opposite graph represents the movement of a body from point (A) to point (C) passing by point (B). Calculate :

    (a) Its speed.   (b) Its velocity.

    (c) The acceleration by which the body moves through (AB).

    (Luxor 2017 / Behira 2020)

14. From the opposite figure calculate :

    (a) Total distance.

    (b) Displacement.

    (c) Velocity after the first five seconds.
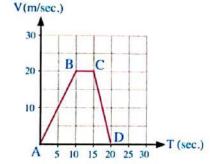
    (Dakahlia, North Sinai 2020)

15. **The opposite graph represents a body moves in a straight line. Answer the following questions :** *(Beni Suef 2020)*
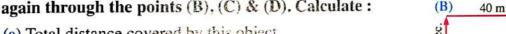
   (a) Mention the kind of acceleration for (AB), (BC) and (CD), then find the value of each kind.

   (b) If the same body covers a displacement equals 200 m in the period (AB) and a displacement equals 100 m in the period (CD). *Calculate :*
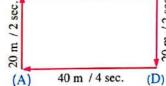
   (1) Displacement covered in period (BC).

   (2) Average speed for the body in period (AD).

16. **The displacement covered by a moving body through different times is recorded in the following table :** *(Port Said 2020)*

Displacement (metre)	10	20	30	40	50	60
Time (second)	5	10	15	20	25	30
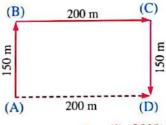
   (a) Represent the relation graphically.

   (b) Calculate the velocity from the graph.

17. **In the opposite figure, an object starts moving from point (A), then it returns to it again through the points (B), (C) & (D). Calculate :**

   (a) Total distance covered by this object.

   (b) Average speed.

   (c) Displacement.

   (d) Velocity. *(Fayoum 2020)*

18. **In the opposite figure, two cars moved at the same time from point (A) to (D), the first car took the pass (ABCD) in 20 sec. and the second car took the pass (AD) with regular speed 20 m/sec.**
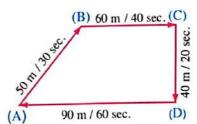
   (a) Which of the two cars reach first to point (D) ? Why ?

   (b) Calculate the velocity of the first car. *(Ismailia 2018)*
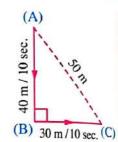
19. **In the opposite figure, a person starts his motion from point (A) to pass with points (B), (C) & (D) till he reaches to starting point (A), where (AB 50 m in 30 sec.) and (BC 60 m in 40 sec.) and (CD 40 m in 20 sec.) and (DA 90 m in 60 sec.). Find :** *(Dakahlia 2018)*

   (a) The average speed.

   (b) The displacement.

   (c) The acceleration in period from (D) to (A) if the speed of the moving person is constant.

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20. 📖 A racer covered 50 metres northward within 30 seconds, then 100 metres eastward within 60 seconds, then 50 metres southward within 10 seconds and then returns back to the start point within 40 seconds : *(Kafr El-Shiekh 2020)*

(a) How long is the total distance the racer moved ?

(b) What is the average speed of the racer ?

(c) What is the displacement ?

(d) What is the average velocity ?

21. In the opposite figure, a body starts its motion from point (A) to the south to point (B), it covers a distance of 40 metres in 10 seconds, then it directs to east to point (C) at a distance of 30 metres from point (B) in 10 seconds.

Complete :
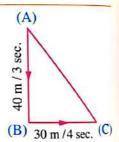
(a) The amount of the body displacement equals ....

(b) Total time spent by the body equals ....

(c) Length of the total distance covered by the body equals .... *(New Valley 2016)*

(d) Average velocity equals .... *(Fayoum 2011)*

(A)
40 m / 10 sec. *50 m*
(B) 30 m / 10 sec. (C)

22. In the opposite figure, a body starts its motion from point (A) directed to the south to point (B), it covers a distance of 40 m through 3 seconds, then it is directed to the east to point (C) which far 30 m apart from point (B) through 4 seconds.

Calculate :
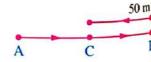
(a) The distance covered.

(b) The average speed. *(South Sinai 2017)*

(A)
40 m / 3 sec.
(B) 30 m / 4 sec. (C)

23. A body moves as shown in the opposite fig. from point (A) to point (B) and covers a distance of 100 m through 20 sec., then to point (C) and covers a distance of 50 m through 5 sec. Calculate :

(a) Distance.

(b) Displacement.

(c) Velocity.

50 m
A   C   B
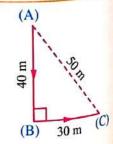
24. In the opposite figure, a body moves from point (A) directed to the south to point (B) through 2 seconds, then it is directed to the east to point (C) through 3 seconds. Calculate :

(a) Average speed.
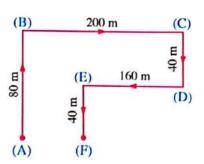
(b) Average velocity. *(Red Sea 2018 / Beni Suef 2020)*

(A)
40 m *50 m*
(B) 30 m (C)

100
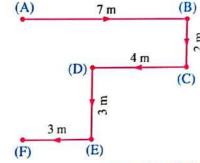
25. **The opposite figure represents a car starts its motion from point (A) to point (F) passing by points (B), (C), (D) and (E). Calculate :**

    (a) Total distance covered by the car.

    (b) Displacement done by the car.

    (c) Velocity if you know that the total time spent by the car equals 10 seconds.
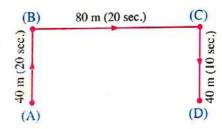
    (Suez 2015)

26. **A body moves in the path (ABCDEF) as in the opposite figure. Calculate :**

    (a) The distance that the body moved.

    (b) Displacement of the body.

    (Kalyoubia 2018)
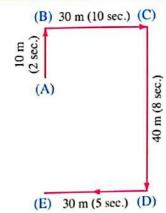
27. **A car starts motion from point (A) and covers 40 metres northward to point (B) within 20 seconds, then 80 metres eastward to point (C) within 20 seconds and then 40 metres southward to point (D) within 10 seconds. Find :**

    (a) Total distance covered by this car.

    (b) Total time that the car took to cover this distance.

    (c) Displacement from the start point to the end point.

    (d) Average velocity of this car.

    (Menia 2017)

28. **A person moves in the path (ABCDE) as shown in figure, he coveres a distance of 10 m northward in 2 sec., then he covers 30 m eastward in 10 sec. and followed by 40 m southward in 8 sec., finally 30 m westward in 5 sec. :**
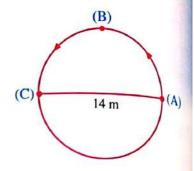
    (a) Calculate the displacement of the person from the start of motion to the end.

    (b) In which part of the person motion, his speed was the least ?

    (Kalyoubia 2019)

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29. In the opposite figure : the perimeter (circumference) of this circle is 44 metres and the diameter is 14 metres. When an object moves from point (A) to point (B) to point (C) in 10 seconds.

Complete :

(a) Distance = ... metres.

(b) Displacement = ... metres in .... direction.

(c) Velocity = ... m/sec. in .... direction.
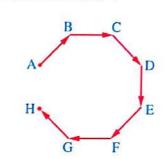
(Beheira 2011)

30. A body moves on a circumference of a circle, if the length of the circumference is 44 metres and its radius is 7 metres, the body makes one and half complete cycle in 6 seconds. Find :

(Luxor 2018)

(a) The distance covered by the body.

(b) The displacement.

(c) The speed.
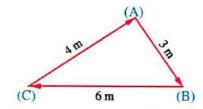
Timss Questions

1. When are the scalars physical quantities added and subtracted ? *(Port Said 2012)*

2. Hany covers a displacement equals 4 km in south direction from his home to the school, while Fouad covers a displacement 2 km in north direction from his home to the same school.

   - What is the displacement that is covered by Hany from his home to Fouad's home ?

3. In the opposite figure, calculate the value of displacement occurred and the covered distance from [A] to [H] [knowing that the length of each side from the figure sides =10 cm.].

4. Choose the correct answer :

   (a) In the opposite figure, a body starts moving from point (A) to point (B) & (C), then it returns to point (A), so the distance that the body moved is more than its displacement by .... metre.
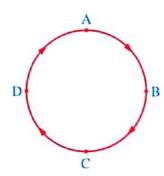
   (a) 7   (b) 9

   (c) 10   (d) 13

   (b) In a bicyclist moved 1500 m eastward, then 1700 m westward, so the difference between the distance and the displacement is .... metre.

   (a) 200   (b) 700   (c) 3000   (d) 3200

5. The opposite figure represents the movement of an object in a circular path along the perimeter of 300 m from point [A] to the same point passing by points B, C and D.

   If you know that the object takes time equals 10 sec. to cover the path ABC, then 20 sec. to cover the path CDA. Calculate.

   (a) Total distance covered.

   (b) Speed of the object.

   (c) Displacement occurred.

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6. In the opposite figure, 6 circles are equal in radii, if the area of one circle is 154 cm².

Calculate the distance and displacement of an object moves along the following paths.

(a) FAD

(b) BCFD

(c) CAB

(d) FCBD

(e) FCBA

7. Suppose that you move from a starting point 3 m eastward, then move 7 m westward and, then 6 m eastward. What is your position now from the starting point.

Project

On UNIT ONE
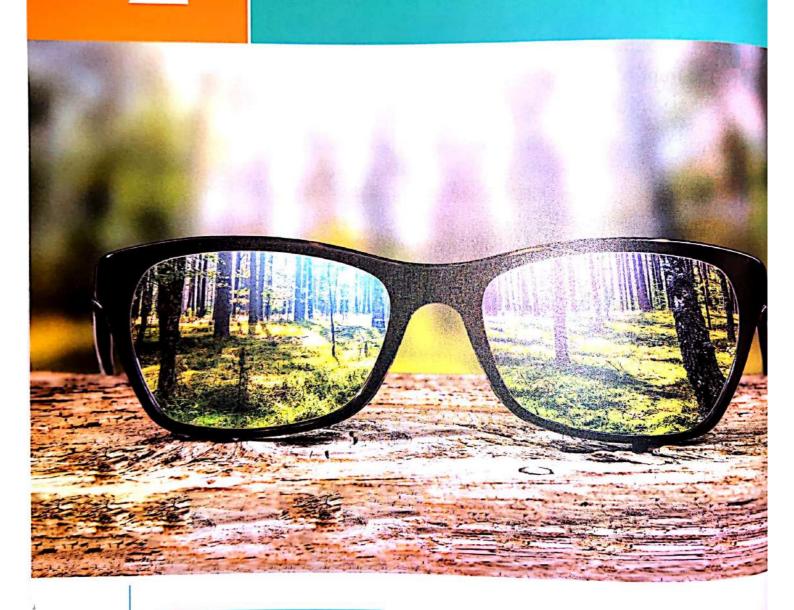
A project to develop the critical thinking
"Distinguish between facts and non-facts"

Some of the following statements represent facts and others doesn't.
Put (✓) in front of that represent facts and (×) in front of others doesn't,
with your scientific evidence :

1. The positive acceleration of a train is more than that its final speed. ( )

2. The speed of a deer is more than the speed of a tiger. ( )

3. The speed of a moving object in (km/h) unit is more than its speed in (m/sec) unit. ( )

4. Sound is one of the electromagnetic waves that transferes in space with a velocity equals 3×10^8 m/sec. ( )

5. Your evaluation to the speed of a moving train differs when you are standing on the plateform, from that when you are in a moving car. ( )

6. There are some integeration aspects between physics and math. ( )

7. Acceleration equals zero for an object moves from rest position. ( )

8. Acceleration of an object which its speed decreases by 10 m/sec. each second, equals to its acceleration when its speed increeases by 10 m/sec. each second. ( )

9. (Distance-Time) graph of an object moves with a regular speed, is the same (Speed-Time) graph of an object moves with a regular acceleration. ( )

10. Distance and displacement are scalar quantities, because they have equal values at any moment for an object moves at a circular path. ( )

Lessons of the unit :

1. Mirrors.
2. Lenses.

▶ Unit Objectives :

By the end of this unit, students will be able to :

- Identify the special concepts of light reflection.

- Identify the properties of the image formed by the plane mirror.

- Identify the two types of the spherical mirrors.

- Identify the usages and applications of spherical mirrors.

- Identify some of the concepts of the spherical mirrors and lenses.

- Identify the properties of the image formed by the spherical mirrors.

- Compare between the convex and concave lens.

- Conduct experiments to explain some of the cases of image formation by the mirrors and lenses.

- Identify the usage of lenses to treat some of the vision defects.

Mirrors

How does a plane mirror form your image ?

There are some observations which we see in our daily life occur as a result of the light reflection, for example :

If you look at a still water surface	If you look at a smooth shiny surface (like mirror)
you can see :	you can see :
The image of the constructed buildings in this still water surface.	The image of your face in the mirror.
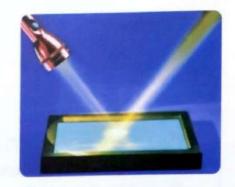
Light Reflection

Light reflection

It is the phenomenon of the light bouncing off (returning back) in the same medium, when it strikes a reflecting surface.

To study the reflection of light, we must know some concepts related to it :

The normal
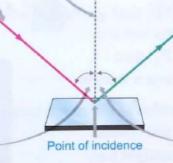
It is the perpendicular line to the reflecting surface on the point of incidence.

The incident light ray

It is the light ray that falls on the reflecting surface.

The reflected light ray

It is the light ray that bounces (returns back) from the reflecting surface.

Angle of incidence

It is the angle between the incident light ray and the normal.

Point of incidence

Angle of reflection

It is the angle between the reflected light ray and the normal.

What is meant by ... ?

- The angle of incidence of a light ray is 60°.

➦ This means that the angle between the incident light ray and the normal is 60°.

- The angle between a reflected light ray and the normal is 60°.

➦ This means that the angle of reflection of this light ray is 60°.

Laws of light reflection

* **Reflection of light is governed by two principal laws.**

To discover these laws, we will carry out the following activity :

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Activity 1 The two laws of light reflection :

Materials :

- A plane mirror.
- Protractor.
- White paper sheet.
- Ruler.
- Pins.

Steps :
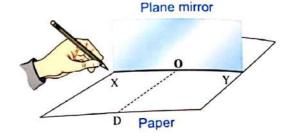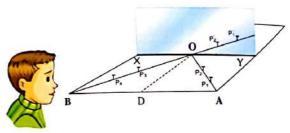
1. Draw a straight line (XY) on the paper, then fix the plane mirror in a perpendicular position on this line as shown in the opposite figure.

2. Draw a line (OD) [**which represents the normal**] perpendicular on the line (XY).

Plane mirror

3. Draw a straight line (AO) [**which represents the incident light ray on the mirror**], which makes an angle ∠ AOD with the normal [**which is called the angle of incidence**] then, measure this angle and place two pins (P_1) and (P_2) horizontal on the line.

4. Look at the other side of the mirror and see the images of the pins (P_1') and (P_2') then place two pins (P_3) and (P_4) to be in a straight line with (P_1') and (P_2').

5. • Lift the two pins (P_3) and (P_4) and connect between their positions with a straight line.

   • Extend the line to meet the reflecting surface at point (O) [**the line (BO) represents the reflected light ray**].

6. By using the protractor, measure the angle ∠ BOD that (BO) makes with the normal [**which is called the angle of reflection**].

Observation :

The angle of incidence = The angle of reflection.
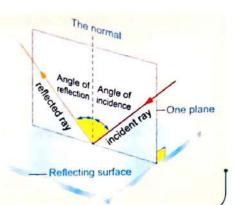
7. Repeat these steps by changing the value of incidence angle (∠ AOD) by using the protractor and assign each time the angle of reflection (∠ BOD).

Observation :

Angle of reflection changes by changing the angle of incidence, where they are always equal.

▶ Conclusion :
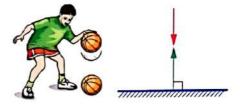
- **Reflection of light is governed by two laws :**

* **First law :** Angle of incidence = Angle of reflection.

* **Second law :** The incident light ray, the reflected
  light ray and the normal line to the reflecting
  surface at the point of incidence all lie in one
  plane perpendicular to the reflecting surface.

GR. | ***The incident light ray which falls perpendicular***
on a reflecting surface, reflects on itself.
Because the angle of incidence equals
the angle of reflection equals zero.

What is meant by ... ❓
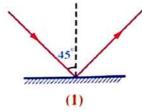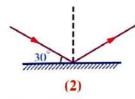
The angle of incidence of a light ray equals zero.
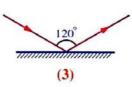
➲ This means that, this incident light ray falls perpendicular on a reflecting surface.

Problems

① *Find the angle of incidence and the angle of reflection for the following figures.*

(1)   (2)   (3)

Solution
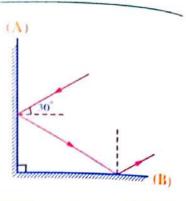
Fig. (1) : ∵ Angle of incidence = Angle of reflection

∴ Angle of reflection = 45°

Fig. (2) : ∵ The angle between the incident ray and the reflecting surface = 30°

∴ The angle of incidence = The angle of reflection = 90° − 30° = 60°

Fig. (3) : ∵ The angle between the incident ray and the reflected ray = 120°

∴ Angle of incidence = Angle of reflection = $\dfrac{120°}{2}$ = 60°

(A)
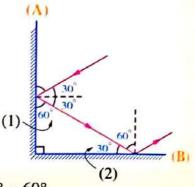
2 *In the opposite figure :*
An incident light ray falls on mirror (A), and then reflected on mirror (B). Calculate each of the following :

(a) The angle of reflection on mirror (A).

(b) The angle of incidence on mirror (B).

(B)

Solution

(a) ∵ The angle of incidence = The angle of reflection

∴ The angle of reflection on mirror (A) = 30°

(b) The angle (1) between the reflected light ray and the mirror (A) = 90° − 30° = 60°

∵ The sum of angles of triangle = 180°

∴ The angle (2) between the incident light ray and the mirror (B) = 180° − (60° + 90°) = 30°

∴ The angle of incidence on mirror (B) = 90° − 30° = 60°

Mirrors

Mirrors are reflecting surfaces for light.

Mirrors are divided into two main types

First
Plane mirrors

Second
Spherical mirrors

A. Concave mirror   B. Convex mirror

FIRST / The plane mirrors

What is meant by ... ❓

The plane mirror.

➲ The plane mirror is a piece of plane glass, painted from behind with a thin layer of silver metal to give the glass a bright surface that reflects the incident light rays that fall on it.

Activity 2 The properties of the image formed by the plane mirror.

Materials :

- A plane mirror.
- A card with some letters written on it.

Steps :

1. Place the card in front of the mirror that is fixed vertically.
2. Record your observation about the properties of the image formed on the plane mirror.

Observation & Conclusion :

The properties of the image formed by a plane mirror are :

1. The image is upright (erect).
2. The image is equal to the object in size.
3. The image is laterally inverted (reversed).
4. The image is virtual.
5. The distance between the object and the mirror equals to the distance between the image and the mirror.
6. The straight line joining the object to its image is perpendicular to the surface of the mirror.

Plane mirror
Laterally inverted image
(where the right hand appears
as a left hand in the mirror)
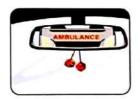
Virtual image

It is the image that cannot be received on a screen

GR. **The word AMBULANCE is written in a laterally inverted way on the ambulance car.**

Because the mirrors of the cars in front of the ambulance car, form a laterally inverted image for this word, and thus it appears laterally corrected to the drivers.
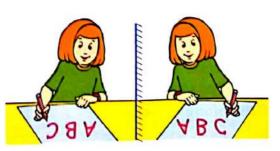
Exercise 1

The opposite figure shows a girl and her image by a plane mirror. Check whether the girl is right handed or left handed.

Answer

The girl is right handed, as the letters are written correctly with the right hand in front of the mirror.

Problems

(1) *If a person stands at a distance of 2 m from a plane mirror. What is the distance between the person and his image ?*
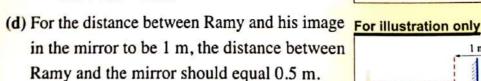
> **Solution**
>
> The distance between the person and the mirror = The distance between his image and the mirror, so the distance between the person and his image = 2 + 2 = 4 m

(2) *Ramy stood at a distance of 4 m from a plane mirror, an image is formed for him.*
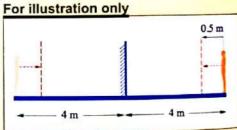
(a) What is the distance between the image of Ramy and the mirror ?

(b) Calculate the distance between Ramy and his image.

(c) If Ramy moves half metre towards the mirror, calculate the distance between Ramy and his image.

(d) Calculate the distance which Ramy should move when the distance between Ramy and his image in the mirror becomes 1 metre.
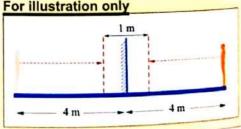
> **Solution**
>
> (a) The distance between the image of Ramy and the mirror = 4 m.
>
> (b) The distance between Ramy and his image = 4 + 4 = 8 m.
>
> (c) ∵ Ramy moves 0.5 m towards the mirror.
>
>   ∴ The distance between Ramy and the mirror
>   = 4 − 0.5 = 3.5 m.
>
>   ∴ The distance between Ramy and his image
>   = 3.5 + 3.5 = 7 m.
>
> **For illustration only**
>
>
> (d) For the distance between Ramy and his image in the mirror to be 1 m, the distance between Ramy and the mirror should equal 0.5 m.
>
>   ∴ The distance, which Ramy should move towards the mirror = 4 − 0.5 = 3.5 m.
>
> **For illustration only**
>
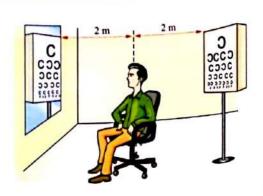
(3) *From the opposite figure,*
Calculate the distance between Samy and the image of the vision chart in the plane mirror.

Solution

- The distance between Samy and mirror (d_1) = 2 m.
- The distance between mirror and image of vision chart (d_2) = 2 + 2 = 4 m.
- The distance between Samy and image of vision chart (d) = $d_1 + d_2$ = 2 + 4 = 6 m.

SECOND / The spherical mirrors

What is meant by ... **?** The spherical mirror.

The spherical mirror

It is a mirror, whose reflecting surface is a part of a hollow sphere.

Types of spherical mirror

A

Concave mirror (converging mirror)

Reflecting surface

B

Convex mirror (diverging mirror)

Reflecting surface

Concave mirror

It is the mirror, whose reflecting (shining) surface is a part of the inner surface of the sphere.
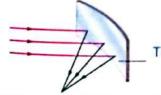
Convex mirror

It is the mirror, whose reflecting (shining) surface is a part of the outer surface of the sphere.
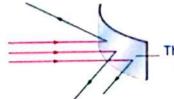
Give a reason

* Concave mirror is called "Converging mirror"

- As it converges (collects) the parallel light rays that fall on its surface.

The inner surface of the sphere

* Convex mirror is called "diverging mirror"

- As it diverges the parallel light rays that fall on its surface.

The outer surface of the sphere

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Life application

The stainless-steel spoon is considered as an example of the spherical mirror as :

Its inner surface acts
as a concave mirror

Its outer surface acts
as a convex mirror

Concepts related to the spherical mirrors :

Concept	Definition	Explaining figure
① **Centre of mirror curvature (C) :**	• It is the centre of the sphere that the mirror is considered as a part of it. Notes : - It lies in front of the reflecting surface in the concave mirror. - It lies behind the reflecting surface in the convex mirror. - Spherical mirrors have only one centre of curvature.	Concave mirror / Convex mirror
② **Pole of the mirror (P) :**	• It is the point that lies in the middle of the reflecting surface of the mirror.	P / P
③ **Radius of mirror curvature (r) :**	• It is the radius of the sphere that the mirror is a part of it. or • It is the distance between the centre of mirror curvature (C) and any point on its reflecting surface.	
④ **Principal axis of the mirror ($\overrightarrow{CP}$) :**	• It is the straight line that passes by the pole of the mirror (P) and its centre of curvature (C). Note : - There is only one principal axis.	

Concept	Definition	Explaining figure
⑤ **Secondary axis of the mirror :**	• It is any straight line that passes by the centre of curvature of the mirror and any point on its reflecting surface except the pole of the mirror. Note : - There are uncountable number of secondary axes.	
⑥ **Focus of the mirror (F) :**	• It is the point of collection of the reflected light rays (in the concave mirror) or their extensions (in the convex mirror). Notes : - It is produced when a parallel beam of rays is incident parallel to the principal axis of a spherical mirror. - The concave mirror has a real focus and it lies in front of the reflecting surface. - The convex mirror has a virtual focus and it lies behind the reflecting surface. - Spherical mirrors have only one focus.	Real focus Virtual focus
⑦ **Focal length of the mirror (f) :**	• It is the distance between the focus of the mirror (F) and its pole (P). Note : - The focus lies at the mid distance between the pole and the centre of curvature. $$f = \frac{1}{2}\, r$$	
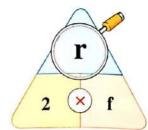
GR. | ***The spherical mirror has only one principal axis and uncountable number of secondary axes.***

It has one principal axis, because it has one centre of curvature and one pole, while it has uncountable number of secondary axes, because any straight line passes by its centre of curvature and any point on its surface except the pole is considered as a secondary axis.

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The relations between the radius, diameter of mirror curvature and its focal length:

> Radius of mirror curvature (r) $=$ 2 × Focal length (f)
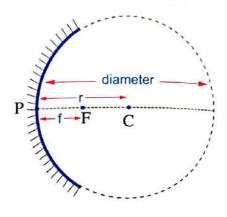
Notes

* Radius of curvature (r) $= \frac{1}{2}$ diameter
* Focal length $= \frac{1}{2}$ radius
* Focal length (f) $= \frac{1}{4}$ diameter

What is meant by ... ?

– The focal length of a spherical mirror is 10 cm.

➲ This means that the distance between the focus of the mirror (F) and its pole (P) is 10 cm.

– The radius of curvature of a spherical mirror is 20 cm.

➲ This means that the distance between the centre of mirror curvature (C) and any point on its surface is 20 cm.

Problems

① *Calculate the radius of curvature of a concave mirror, whose focal length is 8 cm.*

> ### Solution
>
> ∵ Focal length (f) = 8 cm
> ∴ Radius of mirror curvature (r) = 2 × Focal length (f)
> $$= 2 \times 8 = 16 \text{ cm.}$$

② *Calculate the focal length of a concave mirror, whose diameter is 32 cm.*

> ### Solution
>
> Radius of mirror curvature (r) $= \frac{1}{2}$ diameter
> $$= \frac{1}{2} \times 32 = 16 \text{ cm.}$$
> ∵ $f = \frac{1}{2} r$ ∴ $f = \frac{1}{2} \times 16 = 8 \text{ cm.}$
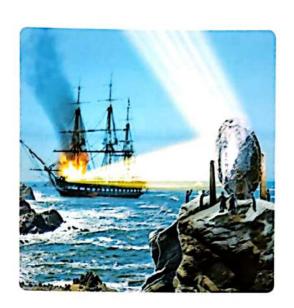
A Concave mirror

Science, Technology and Society

- According to the Old Greek legend that **Archimedes** knew a lot about mirrors and the use of sunlight as a weapon against the Roman fleet that invaded Sicily in 212 B.C.

- A huge concave mirror was placed to collect the Sun rays and directed them towards the sails of ships (which represents the focus of the mirror) so, as to generate extreme heat that led to the burning of these sails and turning them to glazing fire balls.

GR. | **Concave mirror is used to generate high heat energy.**

Because the concave mirror collects the reflected light rays falling on it in one point (focus) generating high heat energy.

The focus of the concave mirror :
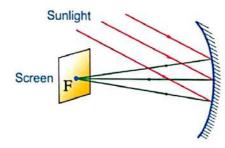
The focus of the concave mirror is produced due to the collection of the reflected rays of the parallel light rays coming from a far light source (as the Sun).

Activity 3 : The focus and the focal length of the concave mirror.

Materials :

- A concave mirror.
- A screen.
- A far light source (as the Sun).

Steps :

1. Place a concave mirror facing the Sun rays (parallel light rays).
2. Move the screen in front of the concave mirror to obtain the smallest and clearest image.
3. Measure the distance between the lit point and the pole of the mirror.

Observation :

The parallel light rays coming from the Sun are reflected and collected in one lit point (smallest and clearest image).

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Conclusions :

1. The point of the collection of the parallel light rays after being reflected from the concave mirror is called "The focus of the mirror".

2. The distance between the focus of the concave mirror and its pole is called "The focal length of the mirror".
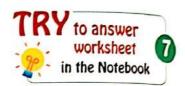
NB Focal length (f) = $\frac{1}{2}$ × radius of mirror curvature (r) $f = \frac{1}{2} r$

📝 **Note**

* Light rays of the Sun are parallel rays and so as any far light source.

TRY to answer worksheet ⑦ in the Notebook

Rules to determine the direction of the reflected light rays incident on the concave mirror:

The path of the incident ray	The path of the reflected ray	Explaining figure
① **Parallel to the principal axis.**	It reflects passing through the focus (F).	
② **Passes through the focus (F).**	It reflects parallel to the principal axis.	
③ **Passes through the centre of curvature (C).**	It reflects back on itself.	

GR. *The light ray that passes through the centre of curvature, reflects on itself.*
Because it falls perpendicular to the spherical mirror so, its angle of incidence equals angle of reflection equals zero.

✳ When you place an object in front of a concave mirror , the position of the formed image and its properties can be determined by using only two rays from the previous three rays, where the image is formed at the intersection of the reflected rays or their extensions.
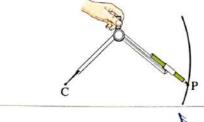
The cases of the formation of the images by the concave mirror (converging mirror) :
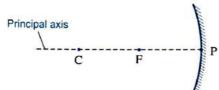
To determine the position and properties of the images formed by the concave mirror, follow the following steps :
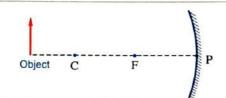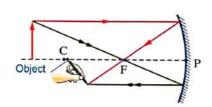
Steps	Explaining figure
1 Use the compass in drawing a curved line that represents the concave mirror. - Then detect both C & P.	
2 Draw the principal axis of the mirror and detect the position of its focus (F) which lies at the mid point between C & P.	
3 Draw a vertical arrow on the principal axis to represent the position of an object.	
4 Draw a ray from the highest point of the object, where it falls parallel to the principal axis and thus reflects passing through the focus. **5** Draw another ray from the same point, where it falls passing through the focus so, it reflects parallel to the principal axis.	
6 Determine the position where the two reflecting rays intersect, which is the image of the highest point of the object.	
7 Determine the position and properties of the formed image.	• **Position of the formed image :** Between (F) and (C). • **Properties of the formed image :** Real, inverted and diminished (smaller than the object).
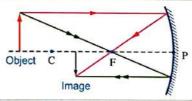
8 Repeat the steps from 4 to 8 several times by changing the position of the object each time.

Real image

It is the image that can be received on a screen.
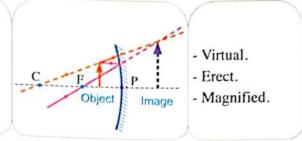
Scanned with CamScanner

Properties of the images formed by the concave mirror :

• The properties of the formed images by the concave mirror are different according to the position of the object from the mirror as the following :

The position of the object from the mirror	The position of the image from the mirror	Shape of the rays path	The properties of the formed image
① Very far [The incident rays are parallel].	At the focus.		- Real. - Very tiny (dot).
② At a distance greater than the radius of curvature. [After the centre of curvature].	At a distance greater than the focal length, but less than the double of focal length [Between the focus (F) and the centre of curvature (C)].		- Real. - Inverted. - Diminished. [smaller than the object].
③ At a distance equals the radius of curvature [At the centre of curvature (C)].	At the centre of curvature (C).		- Real. - Inverted. - Equal to the object.
④ At a distance greater than the focal length, but less than the radius of curvature [Between the focus (F) and the centre of curvature (C)].	After the centre of curvature. [At a distance greater than the radius of curvature].		- Real. - Inverted. - Magnified. [larger than the object].
⑤ At the focus.	No image is formed		No image is formed

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| 6 At a distance less than the focal length [Between the focus (F) and the pole (P)]. | Behind the mirror. | | - Virtual.
- Erect.
- Magnified. |

NB To obtain a virtual, upright and magnified image for your face by a concave mirror, you should stand at a distance less than its focal length.

If the object is put at the focus of the concave mirror, there is no image formed GR.

This is because the extensions of the reflected light rays are parallel to each other (don't intersect).

The radius of curvature of the concave mirror :

To determine the radius of curvature of the concave mirror, we can use the case (3) from the previous cases, as shown in the following activity :

Activity (4) The radius of the mirror curvature.

▶ **Materials :**
- A concave mirror.
- A holder for the mirror.
- A light box with a hole.
- A ruler.

▶ **Steps :**
1. Place the mirror on the holder in front of the light source (the light box which has a hole).
2. Move the mirror nearer and farther until an image of the hole is formed next to it and is equal to it.
3. Measure the distance between the mirror and the formed image of the hole.

▶ **Observation & Conclusion :**
1. The position of the formed image of the hole is called "The center of the mirror curvature".
2. The distance between the mirror and the formed image of the hole is called the radius of mirror curvature.

NB Radius of mirror curvature (r) = 2 f

r ⊜ 2 f

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Uses of concave mirrors :

Concave mirror is a converging mirror, so that it is used for many purposes for example, it is used :

1 In a pocket torch.
To reflect the light of the lamp.

2 In front lights of cars.
To reflect the light of the lamp.

3 In shaving.
To get an enlarged and erect image of the face.
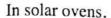
4 In marine lighthouses that are found at marine ports and at airports.
To reflect the light of the lamp to guide ships.

5 In aircrafts landing at airports.
To reflect the light of the lamp to guide aeroplanes.

6 In solar ovens.
To heat food, water .... etc.

7 By dentists.
To form magnified images of the teeth at the back of the mouth cavity (molars teeth).

8 In some types of telescopes.
To monitor the space and also to form enlarged and near images of the celestial bodies.

B Convex mirror

- In the last activity (Activity 4), if the concave mirror is replaced by a convex mirror, the formed image cannot be received on the screen, because it is a virtual image which formed as a result of the intersection of the extentions of the reflected light rays.

The properties of the formed image by the convex mirror :

* Wherever the position of the object in front of the convex mirror, the properties of the formed image is always :
  • Virtual.   • Erect.
  • Diminished.
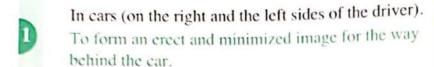
An image formed by a convex mirror

The position of the image formed by a convex mirror is behind the mirror.

For illustration

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Uses of convex mirrors:

Convex mirror is a diverging mirror, so that it is used for many purposes for example, it is used :

1 In cars (on the right and the left sides of the driver).
To form an erect and minimized image for the way behind the car.

2 At shopping centers.
To allow high rates of security at these places.

3 On the corners of narrow roads.
To monitor cars movement on these narrow crossroads to avoid accidents.

4 At cars park.
To monitor cars movement at the park to avoid accidents.

5 At the platforms of the Metro and railway stations.
To avoid passenger injury at opening or closing the Metro doors.

1 Comparison between the focus of the concave mirror and the focus of the convex mirror :

Focus of the concave mirror	Focus of the convex mirror
1. It is a real focus.	1. It is a virtual focus.
2. It is the point of collection of the reflected light rays.	2. It is the point of collection of the extensions of the reflected light rays.
3. It is located in front of the concave mirror.	3. It is located in the back of the convex mirror.
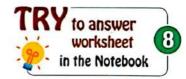
2 Comparison between the real image and the virtual image :

The real image	The virtual image
1. It can be received on a screen.	1. It cannot be received on a screen.
2. It is formed as a result of the intersection of the reflected light rays.	2. It is formed as a result of the intersection of the extensions of the reflected light rays.
3. It is formed in front of the mirror.	3. It is formed behind the mirror.
4. It is always inverted.	4. It is always erect.
5. It is formed in the case of using of : • Concave mirror. [It is diminished, magnified or equal to the object according to the position of the object from the mirror].	5. It is formed in the case of using of : • Concave mirror. [When the object is at a distance less than the focal length and it is magnified]. • Convex mirror. [When the object is at any distance of the mirror and it is diminished]. • Plane mirror. [When the object is at any distance of the mirror and it is equal to the object].

TRY to answer worksheet **8** in the Notebook

Remember

○ Light reflection :

It is a phenomenon of the light bouncing off in the same medium when it strikes a reflecting surface.

○ The incident light ray :

It is the light ray that falls on the reflecting surface.

○ The reflected light ray :

It is the light ray that bounces (returns back) from the reflecting surface.

○ Angle of incidence :

It is the angle between the incident light ray and the normal.

○ Angle of reflection :

It is the angle between the reflected light ray and the normal.

○ Light reflection is governed by two laws :

1. First law :

Angle of incidence = Angle of reflection.

2. Second law :

The incident light ray, the reflected light ray and the normal line to the reflecting surface at the point of incidence all lie in one plane perpendicular to the reflecting surface.

○ Types of mirrors :

1. Plane mirror :

The properties of the image formed by a plane mirror :

- Erect   • Virtual   • Laterally inverted (reversed)
- Image size is equal to the object in size.
- The distance between the object and the mirror is equal to the distance between the image and the mirror.
- The straight line joining the object to its image is perpendicular to the surface of the mirror.

2. Spherical mirror :

It is a mirror, whose reflecting surface is a part of a hollow sphere.

❂ Types of spherical mirrors :

(a) A concave mirror (converging mirror) :

It is a mirror, whose reflecting surface is a part of the inner surface of the sphere and it converges the parallel light rays that fall on its surface.

(b) A convex mirror (diverging mirror) :

It is a mirror, whose reflecting surface is a part of the outer surface of the sphere and it diverges the parallel light rays that fall on its surface.

❂ Concepts related to the mirrors :

• The centre of mirror curvature (C) :

It is the centre of the sphere that the mirror is considered as a part of it.

• The pole of the mirror (P) :

It is the point that lies in the middle of the reflecting surface of the mirror.

• The radius of mirror curvature (r) :

It is the radius of the sphere that the mirror is a part of it.

OR It is the distance between the centre of mirror curvature and any point on its surface.

• The principal axis of the mirror :

It is the straight line that passes by the pole of the mirror (P) and its centre of curvature (C).

• The secondary axis of the mirror :

It is any straight line that passes by the centre of curvature of the mirror and any point on its reflecting surface except the pole of the mirror.

• The focus of the mirror (F) :

It is the point of collection of the parallel rays (which are parallel to the principal axis) after being reflected from the mirror.

• The focal length of the mirror (f) :

It is the distance between the focus of the mirror and its pole.

❂ Real image :

It is the image that can be received on a screen.

❂ Virtual image :

It is the image that cannot be received on a screen.

Questions

on lesson one

Interactive Exercises

1. Choose the correct answer :

1. The bouncing off the light ray in the same medium when it meets a reflecting surface is the .... *(Giza 2017 / Red Sea 2019)*
   a. incident ray.
   b. reflected ray.
   c. light reflection phenomenon.
   d. light refraction phenomenon.

2. If a light ray falls on a reflecting surface by an angle equals 45°, the angle of reflection equals .... *(Damietta 2015)*
   a. 35°.
   b. 90°.
   c. 55°.
   d. 45°.

3. When a light ray falls perpendicular on a reflecting surface, its angle of reflection equals .... *(Menia 2018)*
   a. zero.
   b. 30°.
   c. 60°.
   d. 90°.

4. If the angle between the incident light ray and the reflected light ray is 40°, its angle of reflection equals ....
   a. 20°.
   b. 40°.
   c. 80°.
   d. 90°.

5. A light ray is incident on the surface of a plane mirror, as in the figure it reflects where the angle of incidence equal .... *(Beni Suef 2020)*
   a. 40°.
   b. 50°.
   c. 70°.
   d. 140°.

6. If a person was putting a pen in his left pocket, then the formed image of the pen on a plane mirror will be on the .... side as it is .... *(Luxor 2019)*
   a. left – reversed.
   b. right – up right.
   c. right – reversed.
   d. left – virtual.

7. Which one of these figures represents the correct image for an object placed in front of a plane mirror ? ....

   a.
   b.
   c.
   d.

8. If you stand in front of a plane mirror at a distance of 2 m, the distance between you and your image is ....
   a. 1 m.
   b. 2 m.
   c. 3 m.
   d. 4 m.
   (Ismailia 2019)

9. If the distance of the object to the plane mirror is 10 cm, the distance of its image to the mirror is ....
   a. 5 cm.
   b. 10 cm.
   c. 20 cm.
   d. no correct answer.
   (Behira 2017)

10. The image of the body formed behind the plane mirror is always ....
    a. virtual - enlarged - erect.
    b. real - diminished - inverted.
    c. real - equal - reversed.
    d. virtual - equal - erect.

    (Kafr El-Sheikh 2019, Giza 2020)

11. If you put a plate written on it the word (Light) in front of a plane mirror, it appears in the mirror as a plate written on it ....
    a. Light.
    b. ᴛʜɠiˑ˥ .
    c. ɹʜɡiˑ⅃ .
    d. no correct answer.

12. If a candle is put in front of a plane mirror, which one of the image you see ? ....
    a. 1
    b. 2
    c. 3
    d. 4

13. If the angle of incidence equals 45°, so the angle between the reflected light ray and the reflecting surface equals ....
    a. 45°.
    b. zero.
    c. 90°.
    d. 60°.

14. If a light ray falls on a smooth (plane) mirror as shown in the opposite fig., it reflects by an angle of reflection equals ....
    a. zero.
    b. 30°.
    c. 90°.
    d. 180°. *(New Valley, Damietta 2017)*

15. 📖 A light ray that falls on a plane mirror as in the figure it reflects, where the angle of reflection equals ....
    a. 30°.
    b. 60°.
    c. 90°.
    d. 120°. *(North Sinai, Red Sea 2019)*

16. The reflected light ray when falling on another reflecting surface called .... *(Red Sea 2017)*
    a. the light reflection.
    b. the reflected light ray.
    c. the angle of incidence.
    d. the incident light ray.

17. If you put an object in front of a plane mirror, the ratio between the length of the image and the length of the object is .... *(Kalyoubia 2015 / Matrouh 2017)*
    a. more than one.
    b. less than one.
    c. equal to one.
    d. no correct answer.

18. A body was put in front of a plane mirror at a distance 4 metre, an image is formed behind the mirror. If the mirror moved towards the body one metre, the distance between the first image and the second image is .... metre. *(Behira 2016)*
    a. 1
    b. 3
    c. 2
    d. 4

19. The optical piece which forms an equal laterally inverted image of the body is the ....
    a. convex lens.
    b. concave lens.
    c. spherical mirror.
    d. plane mirror. *(Beni Suef, Port Said 2020)*

20. The point at the middle of the reflecting surface of a spherical mirror is called ....
    a. focus of mirror.
    b. pole of mirror.
    c. centre of curvature.
    d. face of curvature. *(Kalyoubia 2018)*

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21. The straight line that passes by the pole of the mirror and its centre of curvature is expressed the .... *(Beni Suef 2015 / Fayoum 2016 / Alex 2017)*

a. pole of the mirror.
b. secondary axis of the mirror.
c. principal axis of the mirror.
d. no correct answer.

22. The parallel rays that are incident on the plane mirror are reflected back as .... rays.

a. diverging
b. converging
c. parallel
d. refracted

23. The Romans use a huge optical piece to burn the sails of enemies' ships by using the Sun rays. What is the suitable optical piece to do that ? .... *(Port Said 2014, 2018)*

a. Convex mirror.
b. Concave mirror.
c. Plane mirror.
d. Concave lens.

24. The focal length of the mirror is the distance between .... *(Gharbia 2018)*

a. the centre of curvature of the mirror and its pole.
b. the centre of curvature of the mirror and any point on its surface.
c. the focus of the mirror and any point on its surface.
d. the focus of the mirror and its pole.

25. The focal length of a spherical mirror equals .... its radius of curvature.

a. double
b. half
c. quarter
d. four times

(Cairo 2017 / Sohag 2020)

26. The distance from the centre of mirror curvature and its focus equals ....

a. radius of curvature.
b. quarter of the diameter of curvature.
c. diameter of curvature.
d. half of the focal length. *(Suez 2019)*

27. A concave mirror of focal length 5 cm, its diameter of curvature equals ....

a. 5 cm.
b. 10 cm.
c. 15 cm.
d. 20 cm.

28. A concave mirror was cut from hollow spherical glass ball of diameter 16 cm, its focal length is .... *(Red Sea 2017)*

a. 8 cm.
b. 6 cm.
c. 4 cm.
d. 2 cm.

29. A spherical mirror whose radius is 60 cm, its focal length is equal to ....

a. 30 cm.
b. 120 cm.
c. 60 cm.
d. 90 cm.

(Damietta 2016 / Sohag 2019)

30. A concave mirror has a focal vertex (length) of 10 cm, the radius of curvature of its surface equals ....

(Sharkia 2017 / North Sinai 2018)

a. 5 cm.
b. 10 cm.
c. 20 cm.
d. 40 cm.

31. A concave mirror with a focal length of 20 cm, and the object is placed at a distance of 50 cm from the mirror, the image is formed at a distance .... *(Sharkia 2018)*

a. more than 40 cm.
b. more than 20 cm, and less than 40 cm.
c. equals 20 cm.
d. equals 60 cm.

32. A concave mirror of focal length 10 cm, to form a virtual image for a body, the body should be placed at .... from the mirror. *(South Sinai 2017)*

　a. 10 cm　　　b. 15 cm　　　c. 20 cm　　　d. 5 cm

33. A concave mirror of focal length 10 cm, to form an equal image to a body, the body should be placed at .... from the mirror. *(Matrouh 2018)*

　a. 5 cm.　　　b. 10 cm.　　　c. 15 cm.　　　d. 20 cm.

34. A concave mirror has a focal length of 8 cm. an object is placed in front of this mirror forming an image at a distance 20 cm from the mirror. this means that the object is placed at .... from the mirror. *(Kalyoubia 2019)*

　a. 8 cm.　　　b. less than 8 cm.

　c. 20 cm.　　　d. more than 8 cm and less than 16 cm.

35. If a light ray falls on a spherical mirror as shown in the figure, so it reflects by an angle equals .... *(South Sinai 2019, 2020 / Red Sea 2020)*

　a. zero.　　　b. 45°.　　　c. 90°.　　　d. 30°.

36. **In the opposite figure :**
Radius of mirror curvature = ... cm　　　*(Behira 2020)*

　a. 3　　　b. 6　　　c. 9　　　d. 12

37. In the opposite figure, an object is put in front of a concave mirror, a virtual upright magnified image is formed. What is the focal length of the mirror ? .... cm

　a. 2　　　b. 3

　c. 4　　　d. 6

(South Sinai 2020)

38. Light rays coming from the Sun are ....

　a. convergent.　　　b. parallel.　　　c. divergent.　　　d. reflected.

39. The incident light ray at a point on the surface of a concave mirror reflects, where the angle of incidence ....

　a. equals the angle of reflection.　　　b. is more than the angle of reflection.

　c. equals the angle of refraction.　　　d. is smaller than the angle of refraction.

40. Which of these figures represents the correct path of the reflected rays from a concave mirror ? ....

　a.　　　b.　　　c.　　　d.

41. 📖 If a light ray falls parallel to the principal axis of a concave mirror it reflects ....
   a. passing by the spherical centre of the mirror.
   b. passing by the focus.
   c. on itself.
   d. passing by the optical centre. *(New Valley, Qena, Kafr El-Sheikh 2018)*

42. 📖 If the light ray falls passing through the focus of the concave mirror, it will ....
   a. reflect parallel to the principal axis.   b. reflect on itself.
   c. reflect through the centre of curvature.   d. there is no correct answer. *(Aswan 2019)*

43. When the object is very far from a concave mirror, ... image is formed.
   a. very tiny   b. magnified   c. real   d. (a) and (c) are correct

44. If a body is put at a distance less than the focal length of a concave mirror,
   the formed image will be .... *(Giza 2018)*
   a. real, inverted and diminished.   b. real, inverted and same size as the object.
   c. real, inverted and magnified.   d. virtual, upright and magnified.

45. When the object is placed at the centre of curvature of a concave mirror the formed
   image is real, inverted and .... *(Giza, Port Said 2017 / Assiut 2018)*
   a. diminished.   b. equal.   c. magnified.   d. very tiny.

46. A body is placed in front of a concave mirror at a certain distance from its pole, no
   image is formed on the screen, that is because the body is .... *(Luxor 2018)*
   a. placed at infinite distance in front of the mirror.
   b. placed at a distance less than focal length of the mirror.
   c. placed at a distance more than the double of the focal length of the mirror.
   d. placed at a distance equals the double of focal length.

47. If the focal length of a concave mirror equals 10 cm, to obtain a virtual image, the body is
   placed at a distance from the mirror pole that equals .... *(Assiut 2017 / Minia 2020)*
   a. 10 cm.   b. 15 cm.   c. 20 cm.   d. 5 cm.

48. A concave mirror whose radius of curvature is 50 cm, an object is placed at a distance
   that equals .... to form a virtual, erect and magnified image for the object.
   a. 12 cm.   b. 35 cm.   c. 25 cm.   d. 50 cm. *(Kalyoubia 2016)*

49. An object was put at 10 cm from a concave mirror, a real, inverted and equal image
   was formed, if the object moved 3 cm towards the mirror, so the formed image will
   be ....
   a. real, inverted and diminished.   b. real, inverted and enlarged.
   c. virtual and diminished.   d. virtual and enlarged. *(Alex. 2019)*

50. 📖 When the object is at the centre of curvature of a concave mirror, the image is ....
   a. real, inverted and diminished.   b. real, inverted, and equal to the object.
   c. virtual, inverted, and enlarged.   d. real, upright and equal. *(Alex. 2018)*

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51. The spherical mirrors are used in .... *(Fayoum 2015)*
   a. medical glasses.
   b. telescopes.
   c. marine lighthouses.
   d. computers.

52. The optical piece which forms a virtual, erect and diminished image is ....
   a. convex lens.
   b. plane mirror.
   c. convex mirror.
   d. concave mirror. *(Dakahlia 2015)*

53. From the properties of the image formed by a convex mirror is .... *(Ismailia 2019)*
   a. virtual.   b. real.   c. upright.   d. (a) and (c).

54. When an object is placed to face a convex mirror, the formed image .... *(Dakahlia 2019)*
   a. lies behind the mirror.
   b. is real.
   c. is erect.
   d. (a) and (c).

55. A body of length 4 cm is placed at a distance of 8 cm from a convex mirror,
   so the length of the formed image becomes .... *(Cairo 2018 / Luxor 2019)*
   a. 16 cm.   b. 8 cm.   c. 4 cm.   d. less than 4 cm.

2. Choose from column (B) what suits it in column (A) :

(A)	(B)
The position of the object related to the concave mirror.	*The properties of the formed image.*
1. The double of the focal length	a. Virtual, erect and magnified.
2. Very far	b. Real, inverted and larger than the object.
3. Larger than the double of the focal length	c. Virtual, erect and equal to the object.
4. Between the centre of curvature and the focus	d. Real and very tiny.
5. Less than the focal length	e. Real, inverted and equal to the object.
	f. Real, inverted and smaller than the object.

3. Correct the underlined words :

1. The bouncing of the light ray in the same medium when it meets a reflecting surface is expressed by the light refraction phenomenon. *(Fayoum 2015 / Suez 2017)*

2. Light rays is passing when falling on reflected surface. *(Beni Suef 2019)*

3. The incident ray is the light ray that bounces from the reflecting surface. *(Sharkia 2018)*

4. If the angle between the incident light ray and the reflected light ray on a plane mirror equals 140°, so the incident angle equals 40°. *(Menofia 2018 / New Valley 2019)*

5. If the angle between the reflected light ray and the reflecting surface equals 40°, the angle of incidence = 40°. *(Assiut 2016 / Giza 2018)*

6. A light ray that falls on a plane mirror as in the figure, it reflects where the angle of reflection equals 90°. *(Suez 2016 / Alex 2017)*

7. When the light ray falls by an angle of <u>30°</u> on the reflecting surface, so the reflected ray will be perpendicular on the reflecting surface. *(Suez 2019)*

8. The distance between the object and a plane mirror is <u>more than</u> the distance between the plane mirror and the image. *(Cairo 2016 / Port Said 2019)*

9. The image which is formed by the plane mirror is <u>real and inverted</u>. *(Assiut 2019)*

10. The word ambulance is written on ambulance cars <u>minimized</u>. *(Beni Suef 2019)*

11. When the angle between the incident light ray and the reflecting surface is 30°, the angle of reflection is <u>30°</u>. *(Kalyoubia 2020)*

12. The image of the object that is formed by the <u>convex</u> mirror is always virtual, erect and equal to the object. *(Ismailia, Luxor 2017 / Ismailia 2018)*

13. If a person stands at 2 m from a plane mirror, so the distance between the person and his image is <u>6 m</u>. *(Sharkia 2016)*

14. The <u>focus</u> is the point that is in the middle of the reflecting surface of. *(Gharbia 2016 / Minia 2020)*

15. The focal length of the spherical mirror is the distance between the focus and the <u>centre of mirror curvature</u>. *(Cairo 2015)*

16. If the radius of curvature of a concave mirror equals 20 cm, its focal length will be <u>30</u> cm. *(Cairo 2019)*

17. The <u>secondary axis</u> of the spherical mirror is the straight line that passes by the pole of the mirror and its centre of curvature. *(Giza, Suez 2015)*

18. The image of the object that is formed by the <u>converging mirror</u> is always, upright and laterally inverted. *(Suez 2014, 2018)*

19. The concave mirror is called <u>diverging</u> mirror. *(Qena 2018)*

20. In the spherical mirrors, the radius of curvature of the mirror = the focal length $\times \frac{1}{2}$ *(Suez 2018 / Ismailia 2019)*

21. A spherical mirror whose diameter is 40 cm, so its focal length equals <u>40 cm</u>. *(Ismailia 2016 / Giza 2017)*

22. A spherical mirror whose diameter is 12 cm, its focus lies at a distance <u>6 cm</u> from the pole. *(Red Sea 2018)*

23. A concave mirror of a focal length 10 cm, so its radius of curvature = <u>5 cm</u>. *(Kafr El-Sheikh 2018)*

24. <u>Virtual image</u> can be received on a screen. *(Aswan 2015 / Red Sea 2017)*

25. The <u>real</u> image is the image that cannot be received on a screen. *(Red Sea 2019 / Aswan 2020)*

26. The light ray which is incident parallel to the principal axis of a concave mirror, reflects passing by the <u>centre of curvature of its face</u>. *(Menia 2017 / Sohag 2018)*

27. The incident light ray of the concave mirror that passes through the focus, reflects <u>on</u> itself. *(Fayoum 2015)*

28. The light ray that falls on a mirror passing with its centre of curvature, reflects <u>passing through the focus</u>.
(Dakahlia 2016 / Damietta 2017)

29. If you put a lighted body at a distance of 17 cm from a concave mirror, its focal length equals 20 cm, so the image is formed <u>in front of</u> the mirror.

30. If an object is put in front of a concave mirror at the <u>focus</u>, the formed image is real, inverted and equal to the object.
(Cairo 2017 / Gharbia 2019)

31. When putting a body on a distance of 16 cm from a concave mirror its focal length is 12 cm, then the image formed will be <u>virtual upright</u> and magnified image. *(Luxor 2019)*

32. When an object is put between the focus and the centre of curvature of a concave mirror, the formed image is <u>virtual, upright and equal to the object</u>.

33. When an object is put at a distance greater than the radius of curvature of a concave mirror, the formed image is real, inverted and <u>enlarged</u>. *(North Sinai 2016)*

34. When an object is placed at <u>the centre of curvature</u> of a concave mirror, its formed image is real, inverted and enlarged. *(Dakahlia 2017, 2019)*

35. When the object is at the centre of curvature a concave mirror, the image is real, inverted and <u>enlarged</u>. *(New Valley 2018)*

36. The image of the object that is formed by <u>converging</u> mirror is virtual, erect and equal to the object. *(Red Sea 2018)*

4. Write the scientific term of each of the following :

1. • The change in the direction of light ray in the same medium, when it falls on a reflecting surface.
   • The rebounding (bouncing) of the light to the same side when it strikes a reflecting surface. *(Sharkia 2018 / Gharbia 2019)*

2. Angle of incidence = Angle of reflection. *(Assiut 2018 / Sohag 2020)*

3. The incident light ray, the reflected light ray and the normal to the surface of reflection at the point of incidence, all lie in one plane perpendicular to the reflecting surface.
(New Valley 2018 / Port Said 2019)

4. The light ray that falls on the reflecting surface.

5. The light ray that bounces from the reflecting surface.

6. The angle between the incident light ray and the line perpendicular on the reflecting surface. *(South Sinai 2011 / Cairo 2019)*

7. The angle between the reflected light ray and the line perpendicular on the reflecting surface from the point of incidence. *(Giza, Aswan 2018)*

8. A mirror which gives laterally inverted and equal size image for an object.
(Cairo 2015 / Fayoum 2016)

9. A mirror which is a part of a hollow sphere. *(Suez 2019)*

10. A mirror whose reflecting surface is the inner surface of a sphere and converges the light rays. *(Alex. 2017 / Sherkia 2019)*

11. A mirror whose reflecting surface is the outer surface of a sphere and diverges the light rays. *(Kalyoubia 2016 / Behira 2019)*

12. A mirror, always forms a diminished image for the object. *(Giza 2019 / Sharkia 2020)*

13. • A point that is in the middle of the reflecting surface of the spherical mirror. *(Beni Suef 2018 / Red Sea 2019)*

• The mid point on the reflecting surface of the spherical mirror. *(Red Sea 2019)*

14. • The distance between the pole of the mirror and its centre of curvature. *(Kalyoubia 2019)*

• Twice the focal length of a spherical mirror.

• The radius of the sphere that the mirror is a part of it.

15. The straight line that passes by the pole of a spherical mirror and its centre of curvature. *(Kafr El-Sheikh 2019 / Menofia 2020)*

16. The centre of the sphere that the mirror is considered as a part of it. *(Gharbia 2016)*

17. The straight line that passes by the centre of curvature of the mirror and any point on its surface except the pole of the mirror. *(Matrouh 2018 / Red Sea 2020)*

18. • The point of collection of the parallel rays after being reflected from the mirror.

• The point at which the rays which incident parallel to each other and parallel to the principal axis of the concave mirror are collected. *(New Valley 2017 / 2020)*

19. The distance between the pole of the mirror and its focus. *(Beni Suef 2020)*

20. Light rays produced by a distant (far) object.

21. The scientist who used the way of concentrating the Sun rays to destroy the Roman fleet in 212 B.C. *(New Valley, Menia 2019)*

22. The image that can be received on the screen. *(New Valley 2018)*

23. • The image that cannot be received on the screen. *(Dakahlia, Menofia 2020)*

• The image formed always by the convex mirror or sometimes by the concave mirror and can't be received on the screen.

24. A mirror used to get virtual, upright and magnified image for the object. *(Menofia 2016 / 2018)*

25. The spherical mirror which forms virtual, upright and small image for the object, wherever its position in front of the mirror.

26. A light piece of reflecting surface forms a real, inverted and enlarged image. *(Alex. 2017)*

5. Complete the following statements :

1. ▢ The phenomenon of the light bouncing off in the same medium when it meets the reflecting surface is called .... *(Behira 2015 / North Sinai 2018)*

2. **In the opposite figure :**

a) The number .... represents the angle of incidence.

b) The number .... represents the angle of reflection.

3. When a light ray falls on a reflecting surface, the angle between the incident ray and the reflecting surface is 35°, therefore the angle of reflection equals ...., and the angle between the incident ray and the reflected ray equals .... *(Kafr El-Shiekh 2017)*

4. If the angle between the reflected light ray and the reflecting surface = 40°, the angle of incidence equals ....
(Assiut 2014)

5. If the angle between the incident and the reflected rays is 120°, the angle of incidence equals ....
(Ismailia 2017)

6. When a light ray falls perpendicularly on a reflecting surface, its angle of reflection equals ....

7. A person stands in front of a plane mirror at a distance of three metres :
   • The distance between the person and his image = ... metres.
   • If the mirror moves a distance of one metre in the direction of the person, the distance of the image from the first image is .... metre(s).

8. If a body, whose length is 60 cm is placed in front of a plane mirror at a distance 4 cm, the length of its virtual image equals .... and the distance between the body and the image equals .... cm.

9. The distance of the object to the plane mirror .... the distance of its image to the mirror, and the straight line connecting the object and its image is .... to the surface of the mirror.
(Sohag 2020)

10. Mirrors are .... surfaces for light, they may be .... or .... *(Fayoum 2019)*

11. The spherical mirror is a part of .... and it may be .... or ....

12. The concave mirror is a part of a sphere, its .... surface is the reflecting surface and it .... light rays that fall on its surface.
(Dakahlia 2020)

13. .... mirror, whose reflecting surface is a part of the outer surface of the sphere.
(Beni Suef 2016 / Port Said 2017)

14. 📖 The point that is in the middle of the reflecting surface of the concave mirror is called ....
(Assiut, Kafr El-Sheikh 2020)

15. The centre of mirror curvature in concave mirror lies .... the reflecting surface, while it lies in convex mirror .... the reflecting surface.
(Beni Suef 2020)

16. 📖 The straight line that passes by the pole of the mirror and its centre of curvature is ....
(Beni Suef 2017 / New Valley 2017 , 2018)

17. The secondary axis of the spherical mirror is any straight line that passes by .... and any point on its surface except the pole.
(Dakahlia 2018)

18. Focus is the midpoint between .... and ....

19. Spherical mirror has one principle axis and uncountable number of .... axes.
(Beni Suef 2018)

20. 📖 The distance between the focus of the concave mirror and its pole is called ....
(Suez 2016 / Aswan 2019)

21. Focal length = $\dfrac{.........}{2}$
(Port Said 2017)

22. ⬜ The radius of the concave mirror equals .... of its focal length.
(Gharbia 2017 / South Sinai 2019)

23. The incident light ray that falls on a concave mirror passing through the focus, it reflects ...., while the incident light ray passing the center of curvature of the mirror, it reflects ....
(Luxor 2018)

24. The incident light ray passing through the centre of curvature of the mirror, reflects with an angle = ...
(Behira 2017 / Matrouh 2019)

25. ⬜ The incident light rays parallel to the principal axis of the concave mirror, they will reflect passing through ....
(Qena 2017 / Giza 2018)

26. The distance between the image of an object and the concave mirror depends on the distance between .... and ....

27. To obtain a real, inverted and magnified image for a body, we must put it in front of a concave mirror between the .... and the ....

28. When a body lies in front of a concave mirror at a distance .... of its focal length, a real, smaller and .... image is formed.

29. When a body lies in front of a concave mirror at a distance .... than its focal length, but .... than its radius of curvature, a real, inverted and enlarged image is formed.

30. A virtual, erect and enlarged image can be formed by .... mirror.
(Aswan 2015 / Matrouh 2016)

31. If a body is put in front of a concave mirror at a distance of 20 cm, and its image is formed in front of the mirror at a distance of 20 cm, the focal length of this mirror is .... cm.

32. If an object of 8 cm length is put at a distance of 10 cm from a concave mirror its focal length is 5 cm, so the length of the formed image is .... cm. *(Ismailia 2011)*

33. ⬜ The .... image can be received on a screen.
(Cairo 2020)
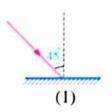
34. The image that cannot be formed on a screen is a .... image.
(Suez 2018)
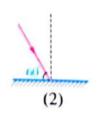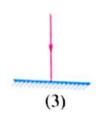
35. The image formed to the object by the .... mirror usually diminished, ... and virtual.
(Alex, Luxor 2017)

36. The radius of curvature of the convex mirror equals .... its focal length.
(Aswan, New Valley 2016 / Port Said 2018)
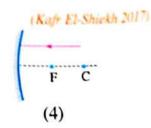
37. ⬜ A convex mirror has a focal length of 20 cm, then the radius of curvature of its spherical surface equals ....
(Assiut 2019 / Giza 2020)

6. Complete the following figures :

(Kafr El-Shiekh 2017)

(1)   (2)   (3)   (4)

(Kafr El-Shiekh 2017)

(5)

(6)

(7)

(8)

(9)

(Assiut 2020)

(10)

7. Give reasons for :
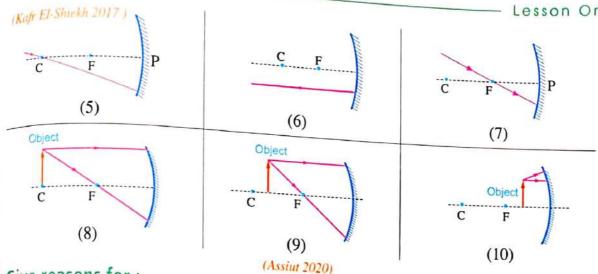
1. • When you look at a mirror, you see your face image.
   (Suez 2019)
   • The human being noticed that when he looked at the still water surface, he could see the image of his face in the water.
   (Sharkia 2020)

2. The perpendicular incident light ray on a plane mirror reflects on itself.
   (Sohag, Red Sea 2019)

3. The angle of reflection of a light ray falls perpendicular on a plane mirror equals zero.
   (Dakahlia 2019)

4. The image formed by a plane mirror is virtual.

5. The image formed by a plane mirror can't be received on a screen.   (Minia 2020)

6. The word AMBULANCE is written in a laterally inverted (reversed) way on the ambulance car.
   (Fayoum 2018 / Qena 2019)

7. • When you look at a plane mirror, you find that you hold the pen by the left hand which is inverse the real position.
   • Most of people can't write in a correct way, while they are seeing their writings through a plane mirror.
   (Port Said 2016)

8. The spoon made of silver is a spherical mirror.

9. The concave mirror is called converging mirror, while the convex mirror is called diverging mirror.
   (Behira 2016)

10. The spherical mirror has only one principal axis and uncountable number of secondary axes.

11. Concave mirror is used to generate high heat energy.   (Dakahlia 2020)

12. The focal length of a concave mirror can be determined by knowing its radius of curvature.
    (Cairo 2018, 2020)

13. The incident light ray on a concave mirror passing through the centre of curvature reflects on itself.
    (Luxor 2014)

14. No image is formed for an object, if it placed at the focus of a concave mirror (explain with drawing).

15. The focus is virtual by the convex mirror.

16. The image formed by a convex mirror is always virtual.   (Beni Suef 2014 / Alex. 2018)

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17. The image formed by the convex mirror cannot be received on a screen. *(Giza 2018)*

18. A convex mirror is put at the left side of the driver of the car. *(Menia, Gharbia 2019)*

19. The real image can be received on a screen, while virtual image cannot.

8. Define each of the following :

1. Light reflection phenomenon. *(Sharkia 2014 / Fayoum 2018)*

2. The first law of light reflection. *(Behira 2014, 2016)*

3. The second law of light reflection. *(Behira, Qena 2016 / Sharkia 2018)*

4. The incident light ray.

5. The reflected light ray.

6. Angle of incidence. *(Matrouh 2018 / Fayoum 2019)*

7. Angle of reflection. *(Cairo, Port Said 2018)*

8. Spherical mirror. *(Giza 2015 / Fayoum 2016)*

9. Centre of mirror curvature. *(Gharbia 2017)*

10. Centre of convex mirror curvature. *(Fayoum, South Sinai 2015)*

11. Radius of mirror curvature.

12. Pole of the spherical mirror. *(Qena 2018, 2020)*

13. Principal axis of the mirror. *(Menia 2016)*

14. Secondary axis of the mirror. *(Aswan 2018)*

15. Focus of the mirror.

16. Focal length of the concave mirror. *(Assiut 2017)*

17. Real image. *(Alex. 2016)*

18. Virtual image. *(South Sinai 2016 / Nourth Sinai 2018)*

9. What is meant by ... ?

1. Light reflection phenomenon. *(Assiut 2019 / Cairo 2020)*

2. The angle of incidence on a reflecting surface is 60°.

3. The angle of reflection of a light ray on a mirror is 30°. *(Alex. 2017 / Qena 2020)*

4. The angle of incidence of a light ray on a plane mirror = zero. *(Dakahalia 2017 / Luxor 2018)*

5. The image formed by a plane mirror is virtual. *(Ismailia 2012)*

6. The radius of curvature of a convex mirror is 8 cm. *(Red Sea 2015 / Alex 2019)*

7. The focal length of a concave mirror = 10 cm. *(Sharkia 2018 / Port Said 2019)*

8. The distance between the principal focus of a spherical mirror and its pole is 20 cm.

(Giza 2018 / Gharbia 2020)

10. Write down the mathematical relation between each of the following :

1. The angle of incidence of a light ray and its angle of reflection. *(Ismailia 2014)*
2. The focal length of a spherical mirror and its radius of curvature.
3. The distance of an object from a plane mirror and the distance of its image from the mirror.

(Ismailia 2014)

11. What happens when ... ?

1. The angle of incidence of a light ray increases from 20° to 50°
2. A light ray falls perpendicular to a plane mirror.

   (Luxor 2016)
3. A light ray is incident by an angle 35° on a plane mirror.

   (Sohag 2018 / Aswan 2019)
4. A light ray that falls on a plane mirror as in the opposite figure.

   (South Sinai 2016)

   60°

5. The body becomes closer to the mirror [concerning : the distance between the image and the plane mirror].

   (Kalyoubia 2018)
6. A light ray is incident on a concave mirror passing through its focus. *(Luxor 2015 / Suez 2018)*
7. Incidence of a light ray parallel to the principal axis of a concave mirror.

   (Cairo 2019 / Beni Suef 2020)
8. The incident light ray passes through the centre of curvature of the concave mirror.

   (Minia, Sohag 2020)
9. A body is placed at the double focal length of the concave mirror.   *(Sohag, New Valley 2016)*
10. • An object is placed between the focus and the pole of a concave mirror.   *(Giza 2015)*

    • A body is placed at a distance less than the focal length of a concave mirror.

    (Port Said 2018)
11. Placing an object between the focus and the centre of curvature of a concave mirror.

    (Beni Suef 2015)
12. A body is placed in front of a convex mirror.   *(North Sinai 2018 / Kafr El-Sheikh 2019)*
13. A plane mirror is put on the left side of the driver of the car instead of a convex mirror.

    (Minia, Red Sea 2020)

12. When do the following things happen ... ?   *(Dakahalia 2018)*

1. Reflection of light ray falls on a concave mirror to pass with its focus.
2. Formation of image which is virtual, upright and smaller than the object behind the mirror.
3. Formation of a real, inverted and equal image for an object that is placed in front of a concave mirror.   *(Giza, Behira 2019)*
4. The angle of incidence of a light ray falls on a plane mirror = zero.   *(Matrouh 2019)*
5. Reflection of light ray falls on spherical mirror on itself.   *(Kalyoubia 2020)*

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13. Show by drawing the path and the directions of rays in the following cases :

1. The path of a light ray that is incident on a plane mirror with an angle 45°.

2. A light ray is incident on a concave mirror parallel to the principal axis.

3. • An object in front of a concave mirror at a distance greater than double focal length, knowing that its focal length is 0.025 m. *(Menia 2019)*

   [Mention the properties of the formed image].

   • The formation of the image of an object at a distance greater than the radius of curvature of a concave mirror. *(Alex. 2014)*

4. • An object in front of a concave mirror at a distance equals the double of its focal length. *(Luxor 2016)*

   • The formation of the image of a body at the centre of curvature of concave mirror.

   [Determine the properties of the formed image]. *(Ismailia 2017 / Cairo 2020)*

5. • An object in front of a concave mirror at a distance is less than its focal length.

   [Determine the properties of the formed image].

   • A concave mirror whose focal length is (8 cm), if a body is placed at (6 cm) from the pole of the mirror. Show by drawing the image formed and mention the properties of this image.

6. • An object in placed at the distance of 15 cm from spherical mirror with a diameter of 40 cm, then an image which could be received on a screen is formed.

   (1) What is the type of the mirror ?

   (2) Determine the position and properties of the formed image. *(New Valley 2019)*

7. • An object in front of a concave mirror at a distance of 7 cm, knowing that its focal length is 5 cm.

   • The formation of the image of a body located in front of a concave mirror between the centre of curvature of a concave mirror and its focus.

   [Determine the properties of the formed image] *(Kafr El-Sheikh 2018)*

8. The formation of the image virtual-upright and magnified by using the spherical mirror.

   (North Sinai 2019)

14. Show by an activity :

1. The two laws of the light reflection.

2. The properties of the image formed by the plane mirror. *(Menia 2017 / Assiut , Ismailia 2018)*

3. Determination of the focal length of the concave mirror.

4. How to determine the radius of curvature of the concave mirror (mention the tools used).

   (Ismailia 2014 / Assiut 2016)

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15. Compare between :

1. First law and second law of light reflection (according to : defination only) *(Fayoum 2018)*
2. Concave mirror and convex mirror. *(Port Said 2020)*
3. Principal axis and secondary axis of a concave mirror. *(Kalyoubia 2018)*
4. Real image and virtual image. *(Cairo, Sohag 2019 / Beni Suef 2020)*

16. Problems :

1. Sun ray is incident on a concave mirror, the image that is formed was real, very small at a distance 2 cm from the reflecting surface of the mirror. The same mirror used to obtain real, inverted and magnified image for another object, draw the path of ray in the second case then calculate the distance between the object and the mirror. *(Matrouh 2017)*

2. If the angle between the incident ray and the reflected ray is 140°, find the angle of incidence and the angle of reflection. *(Aswan 2015 / Sohag 2016, 2017)*
   What is the relation between them ?

3. If the angle between the incident light ray and the reflected light ray on a plane mirror equals 120°, Answer the following questions : *(Kafr El-Sheikh 2015 / Cairo 2017)*
   a. Calculate the angle of incidence.
   b. Calculate the angle between the incident ray and the reflecting surface.

4. If a person stands at 3 m from a plane mirror. Answer the following questions :
   a. What is the distance between the person and his image ? *(Assiut 2017 / North Sinai 2018)*
   b. Write four properties of this image. *(Dakahalia 2018)*

5. A person stands in front of a plane mirror at a distance of 10 metres. What is the distance he must move, so that the distance between him and his image can become 6 metres ?

6. Find the focal length of a concave mirror that its diameter is 20 cm.

17. Variant questions :

1. **Mention the two laws of light reflection.** *(Dakahlia 2015)*

2. **When do we say that .... ?**
   (a) **the angle of reflection for a light ray incident on a plane mirror equals zero.**
   (Menofia 2019)

   (b) **the angle of reflection of a light ray incident on a concave mirror equals zero.**
   (Menofia 2019)

3. **Mention the types of mirrors.**

4. **Mention the properties of the images formed by a plane mirror.**

5. Mention the name of the scientist who used the way of concentration of the Sun rays to destroy the Roman fleet in 212 B.C. *(Luxor 2015)*

6. What are the properties of the image formed by the convex mirror wherever the position of the object ? Mention one use only for this mirror. *(Port Said 2011)*

7. Mention the position of an object in front of a concave mirror if the formed image is : *(Kalyoubia 2018)*
   (a) real, inverted and magnified.
   (b) virtual, erect and magnified.
   (c) real, inverted and minimized.

8. Mention only the tools that are used in the determination of the radius of curvature of a concave mirror, then illustrate the relation between the radius of curvature and the focal length. *(Alex. 2018)*

9. Mention the uses of the concave mirrors.

10. Mention the uses of the convex mirrors.

11. An object is put at a distance of 20 cm from a mirror. The image is formed on a screen and has a length equals to the object. *(Giza 2016)*
    (a) What is the type of the mirror ?
    (b) Calculate the focal length of the mirror.
    (c) Draw the path of rays that show the formation of this image.

12. An object is placed at a distance 8 cm from the pole of a mirror, a real minimized image was formed and when the object moves 2 cm towards the mirror, a real and equals to the object image was formed. *(Luxor 2017)*
    (a) What is the type of the mirror and calculate its focal length ?
    (b) Show by drawing the path of the rays in the first situation.

13. A body of length 1 cm is put at a distance of 4 cm from a concave mirror, its focal length 2 cm.
    (a) Draw a diagram to show the path of the rays at which the eye can see the image of the body.
    (b) Mention the properties of the formed image. *(South Sinai 2016)*

14. Moemen stopped at a distance of 30 centimetres from a plane mirror and saw his image :
    (1) Which of the following represents the properties of the formed image of Moemen ?
       a. Real, erect and magnified.
       b. Virtual, erect and equal to the object.
       c. Virtual, erect and diminished.
       d. Real, erect and equal to the object.
    (2) The distance between Moemen and his formed image on the plane mirror is ....
       a. 30 cm.
       b. 15 cm.
       c. 90 cm.
       d. 60 cm.
    (3) The incident light ray at any point on a plane mirror reflects where the angle of incidence is ....
       a. equal to the angle of reflection.
       b. not equal to the angle of reflection.
       c. equal to the angle of refraction.
       d. not equal to the angle of refraction.

15. **If you looked at a mirror and found your image is erect and magnified.**

    (a) What is the kind of the mirror and at which distance you exist ?

    (b) Can you receive this image on a screen? Give a reason.

16. **A thin walled glass sphere its diameter (42 cm) a suitable part of it was cut. Its inner surface was the reflecting surface :**

    (a) What is the type of the mirror produced in the cut part ? Find its focal length ?

    (b) By drawing only show properties of the image formed by using the cutting part of the sphere, if an object placed at a distance of (10 cm) of its pole ?   *(Menofia 2019)*

17. **A body of length 5 cm is put at a distance of 8 cm from a concave mirror, its focal length is 4 cm.**

    (a) Draw a diagram to show the path of the rays falling on the mirror and the path of the rays that are reflected from it.

    (b) Mention the properties of the formed image showing the length of the image and the radius of the mirror.   *(Port Said 2016)*

18. **A concave mirror with a focal length of 5 cm and an object is placed at a distance of 3 cm from the mirror.**   *(Behira 2018 / Qena 2020)*

    Determine the position of the formed image and its characteristic by drawing and direction of rays.

19. **A concave mirror with a focal length of 6 cm and an object is placed at a distance of 8 cm from the mirror.**   *(Matrouh 2019)*

    Determine the position of the formed image and its characteristics by drawing and direction of rays.

20. **An object is put at a distance of 10 cm from a concave mirror, its focal length is 4 cm.**

    (a) Draw a diagram to show the path of the rays falling on the mirror and the path of the rays that are reflected from it.

    (b) Mention the properties of the formed image.

21. **An object is placed at a distance of 35 cm from a concave mirror with a radius of curvature 40 cm. Mention each of the following :**   *(Kalyoubia 2017 / Gharbia 2019)*

    (a) The focal length of the mirror.

    (b) The properties of the formed image.

    (c) Show by drawing the path of the rays that show the formed image in this case.

22. **An object is placed at a distance 20 cm from a spherical mirror with radius of curvature 20 cm and when the mirror is displaced 5 cm towards the object, an image for the object is formed on a screen.**   *(Dakahalia 2016)*

    (a) Mention the type of the mirror.

    (b) Determine the position of the formed image.

    (c) Write the properties of the formed image.   (d) Show by drawing the path of the rays.

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23. Mahmoud stands in the mid distance between a plane mirror and a concave mirror, two images are formed equal in size, one erect and the other inverted and the distance between the two mirrors 200 cm : *(Damietta 2017)*

(a) Which mirror forms an inverted image ?

(b) What is the focal length of the concave mirror ?

(c) What is the distance between Mahmoud and his image in a plane mirror ?

24. Mention the properties of the formed image when an object is placed in front of a convex mirror. *(Kalyoubia 2019)*
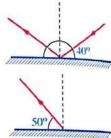
18. Study the following figures and answer the following questions :

1. (a) The value of angle of reflection is ....

(b) **Define :** the angle of incidence. *(Giza 2020)*
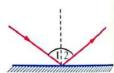
2. In the opposite figure : *(Assiut 2019)*

An incident light ray falls on the plane mirror, calculate the value of the reflected angle?
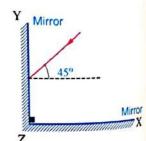
3. In the opposite figure :

(a) Mention the number that represents the angle of reflection.

(b) What is the relation between the two angles ? *(Giza 2016)*

4. Complete :
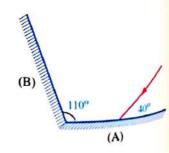
The opposite figure after redrawing it in your answer sheet. Then trace the reflected light ray from the mirror (X).

5. In the opposite figure : *(Behira 2018)*
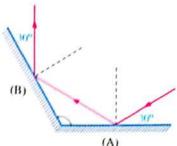
• A light ray falls on a plane mirror (A) and reflects from it towards a plane mirror (B).

• Draw this shape on your answer sheet, then find its angle of reflection from mirror (B) and draw the path of rays on the mirror (B)

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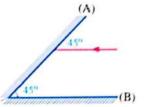
6. **The opposite figure shows two plane mirrors (A) and (B). If a light ray falls on the mirror (A) and reflects in the mirror (B) as in the figure. Calculate each of the following :**

   (a) The angle of incidence of the light ray on a mirror (A).

   (b) The angle of reflection of the light ray from the mirror (B).

   (c) The angle between the two mirrors. *(Kalyoubia 2015)*

7. **From the opposite figure :** *(Luxor 2019)*

   Complete the drawing and calculate the angle of incidence from the mirror (A) on the mirror (B), and mention the reason.
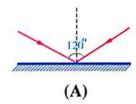
8. **Each of the following figures shows the incident light ray on the surface of a plane mirror. Answer the following :** *(Behira 2020)*
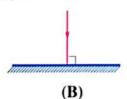
   (a) Calculate the value of angle of incidence in figure (A). *(Kafr El-Sheikh 2013)*
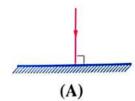
   (b) What is the value of angle of reflection in figure (B) ?

   (A)   **(B)**
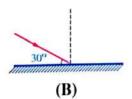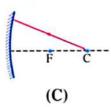
9. **From the following figures compare between the three mirrors according to the angle of reflection.** *(Port Said 2015 / Alex. 2018)*

   (A)   **(B)**   **(C)**

10. **Look at the following figures then answer :**
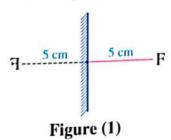
    Figure (1)   **Figure (2)**

    (a) Which of the two figures expresses the formation of F letter image ?

    (b) The other figure is wrong because .... and .... *(Alex. 2019)*

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11. **A candle was put in front of a plane mirror at a distance of 4 cm. An image was formed on the mirror as it is shown in the opposite figure :**

    (a) Which shape (A) , (B) or (C) represents the image of the candle ?

    (b) What are its properties ? (4 only)

12. **A triangle ABC is put in front of a plane mirror (as in the opposite figure) :**
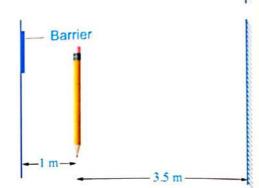
    (a) Redraw the figure in your notebook and show the formed image for the triangle. *(Damietta 2014)*

    (b) Mention two properties only of the formed image.
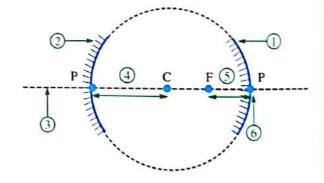
13. **A pencil is placed at a distance of 3.5 m from a plane mirror and there is a barrier behind the pencil at a distance of 1 m.**

    What is the distance between the pencil and the image of the barrier in the mirror ?
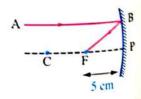
14. **In the opposite figure, identify what is pointed by the arrows :**

    (a) The kind of mirror, number ①.

    (b) The kind of mirror, number ②.

    (c) The line, number ③.

    (d) The distance CP, number ④.

    (e) The distance FP, number ⑤.

    (f) The point P, number ⑥.
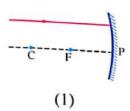
15. **The opposite figure shows a mirror in front of a light source, answer the following :**
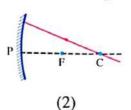
    (a) The line (AB) represents the .... ray.

    (b) The point (F) represents ....

    (c) If the distance between (F) and (P) equals 5 cm, then the distance between (C) and (P) equals .... cm.

    (d) What is the kind of the mirror ?

    (e) Radius of curvature = ... cm.
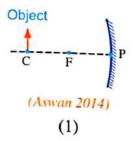
16. Show by drawing the path of the reflected rays in the following cases :

(1)

(2)
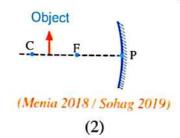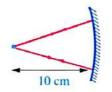
(Gharbia 2013)

17. Draw the following figures in your answer notebook and by drawing two light rays only determine the position and characteristics of the formed image.

(Aswan 2014)

(1)

(Menia 2018 / Sohag 2019)

(2)
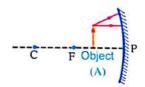
18. In the following figure : Mention the value of :

(a) Radius of curvature.

(b) Focal length.

10 cm

(Beni Suef 2018)

19. Draw the opposite diagram in your answer paper and complete it to obtain an image to the object (A), then mention the properties of the formed image.
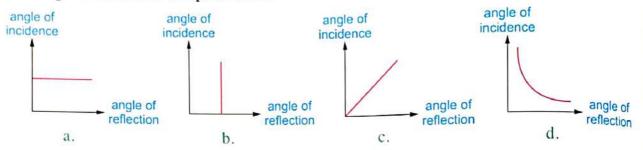
(Sharkia 2016)

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Timss Questions

1. Choose the correct answer :
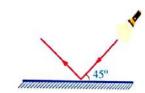
1. Which of the following graphs represents the relation between angle of incidence and angle of reflection of a plane mirror :

a.   b.   c.   d.

2. In the opposite figure :

You can reflect the reflected light ray back in the same path to the light source, if you put a plane mirror :
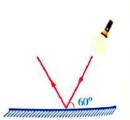
a. In a perpendicular position to the reflected light ray.

b. With an angle of 45° to the reflected light ray.

c. With an angle of 90° to the reflected light ray.

d. Both (a) and (c) are correct.

3. In the opposite figure :

You can get an angle of reflection equals 60° by :

a. Moving the light source by 30° towards the plane mirror.

b. Moving the plane mirror by 30° towards the light source.

c. Moving the light source by 15° towards the plane mirror, and moving the plane mirror by 15° towards the light source.

d. All answers are correct.

4. In the opposite figure :
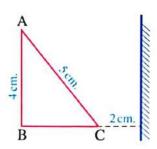
The time in the clock which is placed in front of the mirror refers to ....

a. 1 : 26   b. 10 : 26

c. 10 : 34   d. 11 : 41

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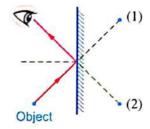
2. Study the opposite figure, then calculate :

The distance between the point (B) and its formed image (ㅂ) ?

3. Study the opposite figure, then determine :
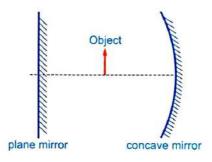
At any positions (1) or (2),

the image of the object appears ?

Give a reason.

4. In the opposite figure :

An object was put in the mid distance between a concave mirror (its focal length is 10 cm) and a plane mirror, so the image was formed by the plane mirror at a distance 30 cm from the plane mirror.

a. Draw the path of light rays for the formed image by the concave mirror.

b. Mention the properties of the formed image by the concave mirror.

Scanned with CamScanner

Lenses

What is meant by lenses ?

Observe the opposite picture, then mention the basic structure in all these optical tools, which are used for different purposes of course it is the lens.

– The lens is usually made of glass or transparent plastic

, So the lens can be defined as follows :

The lens

It is a transparent medium that refracts the light and it is limited with two spherical surfaces.

– In this lesson, we will study :

- Uses of lenses.
- Types of lenses.
- The vision.

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Uses of lenses

Lenses are used in many fields as follows :

1 In medical eye glasses
Either for reading or walking.
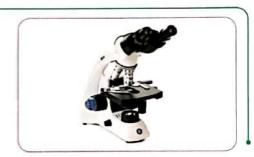
2 In some types of telescopes
To form enlarged and near images for
the celestial bodies.

3 In microscopes
To form magnified images for the tiny
bodies that can't be seen by the naked eye.

4 In binoculars
To see the far object.

5 In magnifier lens
To see the minute parts.

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Types of lenses

lenses have many types, among them are

A
Convex lens (converging lens)

Convex lens

It is a transparent optical piece which is thick at its centre and less thickness at the tips.

B
Concave lens (diverging lens)

Concave lens
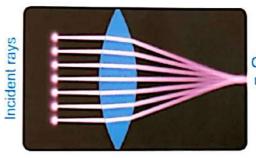
It is a transparent optical piece which is thin at its centre and more thickness at the tips.
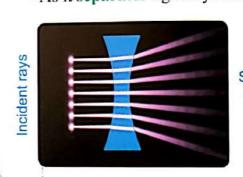
Give a reason

• Convex lens is called "**converging lens**".
  - As it **collects** light rays falling on it.

• Concave lens is called "**diverging lens**".
  - As it **separates** light rays falling on it.

Incident rays

Collective refracted rays

Incident rays

Separated refracted rays

Special concepts related to the lenses :
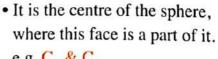
Concept	Definition	Explaining figure
① **The centre of curvature of the lens face (C) :**	• It is the centre of the sphere, where this face is a part of it. e.g. C_1 & C_2 Note : The lens has two centres of curvature.	C_1 C_2 C_1 C_2
② **The optical centre of the lens (P) :**	• It is a point inside the lens that lies on the principal axis in the mid distance between its two faces.	P P
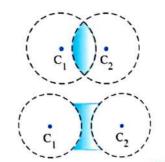
Concept	Definition	Explaining figure
3 The radius of curvature of the lens face (r) :	• It is half the diameter of the sphere, where this face is a part of it.	
4 The principal axis :	• It is the straight line that joins between the two centres of curvature of the lens passing by the optical centre of the lens. Note : The lens has only one principal axis.	
5 The secondary axis :	• It is any line passes by the optical centre of the lens except the principal axis. Note : The lens has uncountable number of secondary axes.	

6
The focus of the lens (F) (principal focus) :
	• It is the point of collection of the refracted light rays (in the convex lens) or their extensions (in the concave lens).
	• It is produced when a beam of parallel rays falls parallel to the principal axis of a lens.
	• It is :
	  - **Real focus** in case of the convex lens.
	  - **Virtual focus** in case of the concave lens.
	Note : The lens has two focuses (foci).	

7 The focal length of the lens (f) :	• It is the distance between the principal focus and the optical centre of the lens.	

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GR.
- **The lens has two centres of curvature.**
- **The lens has two focuses (foci).**

Because it has two spherical surfaces.

? Exercise 1

What happens when a beam of light rays parallel to the principal axis falls on the surface of a convex lens and that of a concave lens ?

Answer

A. Convex lens :

The parallel rays pass through the convex lens, then they are converged and collected in a real focus of the lens.

B. Concave lens :

The parallel rays pass through the concave lens, then they are diverged and their extensions are collected in a virtual focus of the lens.

A Convex lens

The focus of the convex lens (converging lens) :
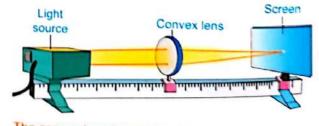
If Sun rays or light rays from any distant source fall on the lens, we notice that the rays passing through the lens are collected in one point called "the focus of the lens".

Activity — To determine the focus and the focal length of the convex lens :

▶ Materials :

- A convex lens.
- A light source.
- A screen.

The convex lens forms a real, inverted, smaller (tiny) image of the distant object

▶ Steps :
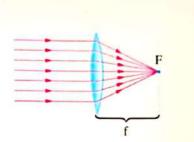
1. Fix the lens where the light source is facing one of its faces.
2. Move the screen closer and farther from the other side of the lens until you get the lit point.
3. Measure the distance between the lit point and the optical centre of the lens.

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▶ **Observations :**

The rays after being refracted are collected in one lit point is called the focus of the lens that can be received on the screen.

▶ **Conclusions :**

1. The convex lens is a converging lens as it collects the refracted light rays.

2. The point of collection of the parallel rays (produced from the Sun or any distant object) after being refracted from the convex lens is called "the focus of the lens (F)".

3. The distance between the focus of the lens and its optical centre is called "the focal length of the lens (f)".

$$f = \frac{1}{2} r$$

GR.

• **The formed image by the convex lens can be received on the screen.**

Because it is a real image formed by the collection of the refracted light rays.

• **A piece of paper can be burnt by a convex lens.**

Because convex lens can converge and concentrate the parallel rays of sunlight in a point (real focus) which leads to the burning of this paper.

The convex lens forms a real image of the Sun on a piece of paper

? Exercise 2

Which of the opposite lenses has a larger focal length ? and why ?

(A) Thin lens.   (B) Thick lens.

Answer

(A) Thin lens

It has a large focal length.

Thin lens

The reason :

As the convexity of its lens face is small so, the focus is farther to the optical centre.
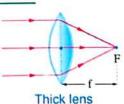
(B) Thick lens

It has a small focal length.

Thick lens

The reason :

As the convexity of its lens face is large so, the focus is nearer to the optical centre.

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Rules for determining the direction of the light rays after passing through the convex lens :

The path of the incident ray	The path of the emergent ray	Explaining figure
1 Parallel to the principal axis.	It exits (or refracts) from the lens passing through the focus.	
2 Passes through the focus.	It exits (or refracts) from the lens parallel to the principal axis.	
3 Passes through the optical centre.	It passes through the lens without refraction.	

- When you place an object in front of a convex lens, the position of the formed image and its properties can be determined by using only two rays from the previous three rays, where the image is formed at the intersection of the refracted rays or their extensions.
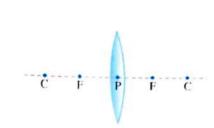
The cases of the formation of the images by the convex lens (converging lens) :
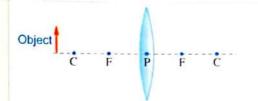
To determine the position and properties of the formed images by the convex lens, follow the following steps :

Steps	Explaining figure
1 Use the compass to draw two identical intersected circles, where : • The region of intersection represents the convex lens. • The two centres of the two circles represent the two centres of curvature of the lens (C).	

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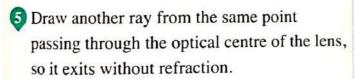
2 • Draw a straight line that joins between the two centres of curvature of the lens to represent the principal axis of the lens.

• Put a point in the mid distance between the two lens faces on the principal axis to represent the optical centre of the lens (P).

• Put two points in the mid distance between (C) & (P) to represent the two focuses of the lens (F).

3 Draw a vertical arrow on the principal axis to represent the position of the object.
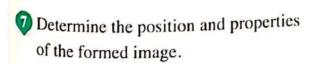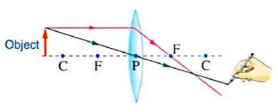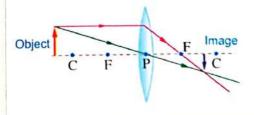
4 Draw a ray from the highest point of the object, where it falls parallel to the principal axis and thus refracts and exits passing through the focus.

5 Draw another ray from the same point passing through the optical centre of the lens, so it exits without refraction.

6 Draw an arrow, whose head is at the position of the intersection of the two refracting rays, to represent the formed image of the highest point of the object.

• **Position of the formed image :** Between (F) and (C).

7 Determine the position and properties of the formed image.

• **Properties of the formed image :** Real, inverted and diminished (smaller than the object).
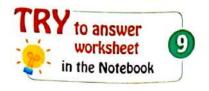
8 Repeat the steps from 3 to 7 several times by changing the position of the object each time.

Scanned with CamScanner

Properties of the formed images by the convex lens

The properties of the formed images by the convex lens are different according to the position of the object from the lens as the following :

The position of the object from the lens	The position of the image from the lens	Shape of the rays path	The properties of the formed image
1 Very far [the incident rays are parallel].	At the focus		– Real. – Very tiny [dot].
2 At a distance greater than the double of focal length. [After the centre of curvature].	Between the focus and the centre of curvature.		– Real. – Inverted. – Diminished [smaller than the object].
3 At a distance equals to the radius of curvature [At the centre of curvature (C)].	At the centre of curvature (C).		– Real. – Inverted. – Equal to the object.
4 At a distance greater than the focal length, but less than the radius of curvature [Between the focus (F) and the centre of curvature (C)].	After the centre of curvature.		– Real. – Inverted. – Magnified. [larger than the object].
5 At the focus.	No image is formed.		
6 At a distance less than the focal length [Before the focus].	The image is formed farther than the object position [according to the lens], and in its same direction.		– Virtual. – Erect. – Magnified.

TRY to answer worksheet in the Notebook **9**
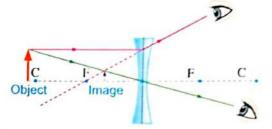
B Concave lens

- In the last activity, if the convex lens is replaced with a concave lens, the formed image cannot be received on the screen, because it is a virtual image formed as a result of the intersection of the extensions of the refracted light rays.

The properties of the formed image by the concave lens :

* **The position of the object :** Wherever the position of the object in front of the concave lens.

* **The position of the image :** The image is formed nearer to the object position (according to the lens), and in its same side.

* **The properties of the formed image is always :**

  - Virtual.   - Erect.   - Diminished.
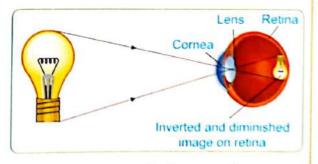
The vision

For illustration

How does the vision occur ?

- The light rays reflected from the body to fall on the eye, refract when passing through the cornea, then the eye lens (convex lens).

- The refracted light rays fall on the retina forming a real, inverted and diminished image.

- The optic nerve transmits the image to the brain which re-corrects the image to become erect and in its normal size.

• The diameter of the eyeball is the distance between the optical centre of the lens and the retina.

• To see clearly, the image must be formed **exactly** on the retina.

• The normal person can see clearly :

  - Near objects (at a distance not less than 25 cm).

  - Far objects (at a distance not more than 6 m).

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The use of lenses to treat vision defects :

- The most important vision defects are :

1. Short-sightedness.

2. Long-sightedness :

Short-sightedness :

Long-sightedness :

Short-sightedness :

It is a vision defect through which near objects only can be seen clearly but far objects seem distorted.

Far object seems distorted

Long-sightedness :

It is a vision defect through which far objects only can be seen clearly but near objects seem distorted.
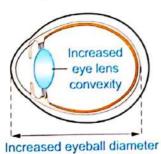
Near object seems distorted

Reasons :

1. Increase in the eyeball diameter.
This causes the retina to be far from the eye lens.

2. Increase in the convexity of the eye lens surface.
This causes a shorter focal length for the eye lens.

1. Decrease in the eyeball diameter.
This causes the retina to be close to the eye lens.

2. Decrease in the convexity of the eye lens surface.
This causes a longer focal length for the eye lens.

Increased eye lens convexity

Increased eyeball diameter

Normal eye lens convexity

Normal eyeball diameter

Decreased eye lens convexity

Decreased eyeball diameter

1
Short-sightedness :
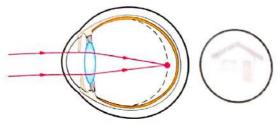
2
Long-sightedness :
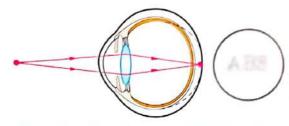
This leads to :

The light rays coming from the far object are collected at a point in front of the eye retina and disperses after that forming an **unclear image**.

Formation of unclear image in front of the retina.

The light rays coming from the near object are collected at a point behind the eye retina and disperses after that forming an **unclear image**.
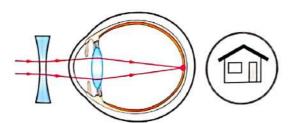
Formation of unclear image behind the retina.

Correction :

It is corrected by using a **concave lens** which diverges the rays before falling on the eye, so the image of the object is formed **exactly** on the retina.

Therefore, short-sighted person needs a medical eye glasses with **concave lenses**.

Formation of clear image on the retina by using a concave lens

It is corrected by using a **convex lens** which collects the rays before falling on the eye, so the image of the object is formed **exactly** on the retina.

Therefore, long-sighted person needs a medical eye glasses with **convex lenses**.

Formation of clear image on the retina by using a convex lens
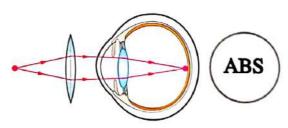
GR. *The concave lens is used to correct the short-sightedness.*

Because it diverges the rays coming from the far objects before falling on the eye, so the image is formed **exactly** on the retina.

GR. *The convex lens is used to correct the long-sightedness.*

Because it collects the rays coming from the near objects before falling on the eye, so the image is formed **exactly** on the retina.

Contact lenses :

- The contact lenses are used instead of the medical glasses to treat the vision defects.

The contact lens :

It is a very thin lens made of plastic and can stick to the eye cornea by the eye fluid.

The contact lens

Science, Technology and Society

Cataract [science integration (Medicine)] :

- Cataract is one of the most dangerous diseases that infects the eye.

Cataract :

It is a disease that causes a difficulty of vision as a result of the darkness of the eye lens.

The eye is infected by cataract

- **The reasons for cataract disease are :**

① Old age.
② Illness.
③ Side effects of drugs.
④ Genetic readiness.

- **The result of cataract is :**

The difficulty of vision as a result of the darkness of the eye lens.

- **Treatment of cataract :**

Treatment is done through a surgery to exchange the eye lens (decayed) with a transparent plastic lens transplanted permanently in the eye. So, the person can see again clearly.

Land areas measurement :
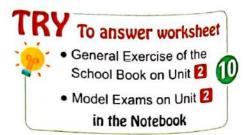
Land surveyors and topographical scientists use a special device to determine heights and distances by sending a beam of laser rays, then receiving it again by the mirrors and lenses provided in their devices.

So, it is possible to make very accurate measurements by calculating the time that the laser beam bounced from a distant point and returns to its source.

To measure the distance:

$$d = \frac{v \times t}{2}$$

TRY To answer worksheet

- General Exercise of the School Book on Unit **2** ⑩
- Model Exams on Unit **2** in the Notebook

Remember

❂ The lens :

It is a transparent medium that refracts the light and is limited with two spherical surfaces.

❂ Uses of lenses :

- In medical eye glasses.
- In making of telescopes and microscopes.
- In fixing the watches using a magnifier lens.
- In manufacturing projectors, cameras and magnifying lenses.
- In war, the leaders use binoculars to follow the battles.

❂ Types of lenses :

1. A convex lens "converging lens" :

- It is thick at the centre and less thickness at the tips.
- It collects light rays falling on it after refraction.

2. A concave lens "diverging lens" :

- It is thin at its centre and more thick at the tips.
- It separates light rays falling on it after refraction.

❂ Concepts related to the lenses :

• The centre of curvature of the lens face (C) :

It is the centre of the sphere, where this face is a part of it.

• The optical centre of the lens (P) :

It is a point inside the lens that lies on the principal axis in the mid distance between its faces.

• The radius of curvature of the face of the lens (r) :

It is half the diameter of the sphere, where this face is a part of it.

• The principal axis of the lens :

It is the straight line that joins between the two centres of curvature of the lens passing by the optical centre of the lens.

• The secondary axis of the lens :

It is any line passes by the optical centre of the lens except the principal axis.

- **The focus of the lens (F) (Principal focus) :**

  It is the point of collection of the refracted light rays (in the convex lens) or their extensions (in the concave lens).

- **The focal length of the lens (f) :**

  It is the distance between the focus and the optical centre of the lens.

Comparison between short-sightedness and long-sightedness :

Points of comparison	Short-sightedness	Long-sightedness
1 The images of near (close) objects :	Can be seen clearly.	Cannot be seen clearly.
2 The images of far objects:	Cannot be seen clearly.	Can be seen clearly.
3 The position of the images concerning the retina :	In front of the retina.	Behind the retina.
4 Causes :	- Increase in the eyeball diameter. OR - Increase in the convexity of the eye lens surface.	- Decrease in the eyeball diameter. OR - Decrease in the convexity of the eye lens surface.
5 The correction :	By using a concave lens.	By using a convex lens.

✪ Contact lenses :

They are very thin lenses made of transparent plastic and can stick to the eye cornea by the eye fluid.

✪ Cataract disease :

It is a disease that infects the eye lens, so it becomes dark.

Questions
on lesson two

Interactive Exercises

1. Choose the correct answer :

1. Lenses used in the ....
   - a. cameras.
   - b. medical glasses.
   - c. binoculars.
   - d. all the previous things.

2. Concave lens is called .... lens.
   - a. diverging
   - b. converging
   - c. collecting
   - d. no correct answer

   (Gharbia 2018)

3. The convex lens ....
   - a. is thin at the centre and more thickness at the tips.
   - b. is thick at the tips and less thickness at the centre.
   - c. is collectes the light rays falling on it.
   - d. is diverges the light rays falling on it.

4. The straight line that joins between the two centres of curvature of the lens and passes through its its optical centre is called .... *(Sharkia 2017 / Cairo 2018)*
   - a. the focal length.
   - b. the principal axis.
   - c. the secondary axis.
   - d. the radius of curvature.
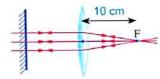
5. To determine the focal length of a lens, the mathematical relationship .... can be used.
   - a. $f = \dfrac{r}{2}$
   - b. $f = r \times 2$
   - c. $f = \dfrac{2}{r}$
   - d. $f = \dfrac{1}{4} r$

   (Damitta 2015)

6. From the opposite figure, the radius of curvature is ....
   - a. 5 cm.
   - b. 10 cm.
   - c. 15 cm.
   - d. 20 cm.

7. If the focal length of a concave lens is 6 cm, the radius of curvature equals ....
   - a. 3 cm.
   - b. 6 cm.
   - c. 9 cm.
   - d. 12 cm.

   (Kafr El-Sheikh, Suez 2016)

8. A convex lens, the distance between its focus and its optical centre is 10 cm, so the double of the focal length is .... *(New Valley 2018)*
   - a. 10 cm.
   - b. 20 cm.
   - c. 30 cm.
   - d. 40 cm.

9. If the radius of curvature of a lens is 40 cm, its focal length equals .... *(Sohag 2018)*
   - a. 5 m.
   - b. 10 cm.
   - c. 20 cm.
   - d. 50 cm.

10. If the distance between the two centres of curvature of the lens is 20 cm, this means that the focal length is .... *(Kalyoubia 2018 / Beni Suef 2019)*
    - a. 5 cm.
    - b. 10 cm.
    - c. 15 cm.
    - d. 20 cm.

11. The distance .... is the focal length of the lens.
    a. PQ
    b. PS
    c. QR
    d. QS

12. The convex lens which has great thickness from the following, its focal length is ....
    a. 4 cm.
    b. 6 cm.
    c. 8 cm.
    d. 10 cm.
    (Kalyoubia 2020)

13. ☐ If a light ray falls passing through the optical centre of the convex lens, it leaves the lens .... *(Alex. 2014 / Assiut 2019)*
    a. passing through the focus.
    b. parallel to the principal axis.
    c. without refraction.
    d. no correct answer.

14. If a light ray falls on a convex lens and passing through its focus, it ....
    a. passes in a straight line without deviation.
    b. refracts parallel to the principal axis.
    c. passes from the optical centre in a straight line.
    d. no correct answer.

15. ☐ A convex lens with a focal length of 20 cm, and an object was placed at 40 cm from the lens, the image of the object is formed at .... *(Menia 2017 / South Sinai 2018)*
    a. 40 cm.
    b. 20 cm.
    c. 10 cm.
    d. 5 cm.

16. A convex lens its focal length 5 cm, put a body at a distance more than the double of its focal length, the formed image is real, inverted and small at a distance .... cm.
    a. 5
    b. 8
    c. 10
    d. no correct answer
    (Red Sea 2019)

17. Which of these figures represents the correct image formed by a convex lens ? ....

18. The optical piece that forms an equal, laterally inverted image of the body is the ....
    a. spherical mirror. b. plane mirror.
    c. convex lens.
    d. concave lens.
    (Kalyoubia, Assiut 2017)

19. The optical piece which forms virtual, upright and diminished image of the body is ....
    a. convex mirror.   b. plane mirror.
    c. convex lens.
    d. concave mirror.
    (Behira 2017)

20. When the object is at the centre of curvature of the lens (C), the image is formed at a distance .... the radius of curvature.
    a. equals to
    b. greater than
    c. smaller than
    d. no correct answer.

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21. ☐ An object when it is placed at a distance less than the focal length of the convex lens, the properties of the image formed are .... *(Beni Suef 2014)*
    a. real, inverted and enlarged.
    b. real, inverted and smaller.
    c. virtual, upright and enlarged.
    d. no correct answer.

22. ☐ An object is placed at the focus of a convex lens, the image will be ....
    a. between the focus and the centre of curvature.
    b. at the centre of curvature.
    c. not formed.
    d. no correct answer.
    (Gharbia 2015 / North Sinai 2017)

23. If an object is put at a distance greater than the double of focal length of a convex lens, the image is formed ....
    a. between the focus and the centre of curvature.
    b. at the double of focal length.
    c. at infinity.
    d. in front of the lens in the same side.

24. If an object is placed at a distance more than the twice of the focal length from convex lens its focal length 5 cm and the image which formed is an inverted, real and smaller at a distance .... cm.
    (Aswan 2020)
    a. 3.
    b. 5.
    c. 8.
    d. 10.

25. On putting a torch in front of a convex lens at a distance equals its focal length, the light rays emerged from the lens are ....
    a. parallel.
    b. diverged.
    c. converged.
    d. no correct answer.

26. ☐ A convex lens has a focal length of 50 cm an object is placed at a distance of 80 cm from the lens, the image of the object is formed at a distance of ....
    a. greater than 100 cm.
    b. equals 100 cm.
    c. equals 50 cm.
    d. no correct answer.
    (Menofia 2016 / Kafr El Sheikh 2019)

27. A lens is placed in the passage of Sun rays, a very small image for the Sun is formed at a distance 20 cm from the optical centre of the lens, if this lens is used to form a real, inverted and enlarged image for another body. What is the distance between the body and the optical centre of the lens ? ....
    a. 10 cm.
    b. 20 cm.
    c. 30 cm.
    d. 40 cm.

28. Which of the following figures represents the correct path of rays through the convex lens ? .... *(Beni Suef 2017)*

a.   b.   c.   d.

29. An object is placed at 80 cm from a convex lens of focal length 20 cm. The image of the object is formed at a distance .... cm from the lens. *(Qena 2018)*
    a. 30
    b. 50
    c. 100
    d. 133

30. A body of length 4 cm is placed at a distance of 8 cm from a convex mirror, so the length of the formed image becomes .... *(Gharbia 2020)*
    a. 16 cm   b. 8 cm   c. 4 cm   d. less than 4 cm

31. The virtual image is always formed by the .... *(Sohag 2017 / Luxor 2018)*
    a. plane mirror.   b. convex mirror.
    c. concave lens.   d. all the previous answer.

32. The virtual-upright magnified image formed in case of .... *(Cairo 2020)*
    a. concave lens.   b. convex mirror.
    c. plane mirror.   d. concave mirror and convex lens.

33. The ratio between the body length and its image formed by a concave lens is .... one.
    a. more than   b. less than   c. equal to   d. no correct answer
    (Luxor 2017)

34. The image formed by using a concave lens is .... *(Behira 2018 / Assiut 2019)*
    a. real, inverted and enlarged.   b. virtual, inverted and diminished.
    c. virtual, upright and diminished.   d. virtual, inverted and enlarged.

35. The image formed by .... is always virtual, erect and small. *(Cairo 2019)*
    a. convex lens   b. concave mirror
    c. plane mirror   d. convex mirror and concave lens

36. The person with normal vision sees the object clearly at a distance not less than ....
    a. 25 cm.   b. 20 cm.   c. 15 cm.   d. 10 cm.
    (South Sinai 2016 / Sharkia 2019)

37. Vision defects occur because ....
    a. the eye lens is not always convex.   b. the eyeball is always spherical.
    c. the eyeball is not always spherical.   d. (a) and (c).

38. Short-sightedness person is the person who ....
    a. sees the far only objects clearly.   b. sees the far and near objects unclearly.
    c. sees the near objects only clearly.   d. can't see neither far nor near objects.

39. In short-sightedness, ...
    a. the images of the near objects is formed behind the retina.
    b. the eyeball diameter is large.
    c. the eyeball diameter is small.
    d. no correct answer.

40. A .... is used to correct the short-sightedness.
    a. convex lens   b. convex mirror   c. concave mirror   d. no correct answer

41. A .... is used to correct the long-sightedness.
    a. convex mirror   b. concave lens   c. concave mirror   d. no correct answer

42. A short-sighted person sees the far objects distorted as their images formed ....
    a. on the retina.   b. behind the retina.
    c. in front of the retina.   d. in front of the lens.
    (Menofia 2019 / Damietta 2020)

43. The long-sightedness leads to the collection of rays .... the retina.
   a. on
   b. behind
   c. in front of
   d. below

44. The person who suffers from long-sightedness is treated by using ....
   a. a concave mirror.
   b. a concave lens.
   c. a convex lens.
   d. a convex mirror.

45. The short-sighted person needs a medical eye glasses with .... lenses.
   a. convex
   b. concave
   c. plane
   d. convex and concave

46. A doctor advised a person who has a sight defect to use glasses with convex lenses, it means that this person suffers from ....
   a. a decrease in the convexity of the eye lens surface.
   b. an increase in the convexity of the eye lens surface.
   c. an increase in the eyeball diameter.
   d. disability of seeing far objects clearly.

47. .... lenses are used instead of glasses.
   a. Concave
   b. Convex
   c. Contact
   d. Converging

48. Contact lenses can stick to the eye .... by the eye fluid.
   a. retina
   b. cornea
   c. lens
   d. no correct answer

49. From the causes of cataract is ....
   a. genetic readiness.
   b. old age.
   c. effect of drugs.
   d. all the previous answers.

2. Correct the underlined words :

1. The lens is a transparent medium that <u>reflects</u> the light and is defined with two spherical surfaces.
2. The <u>concave mirror</u> is a transparent medium that refracts the light and is limited with two spherical surfaces.
3. The types of lenses are concave and <u>plane</u>.
4. The <u>concave</u> lens is converging lens.
5. The concave lens <u>collects</u> the rays fall on it.
6. The concave lens <u>converges</u> the light rays that falling on its surface.
7. Each lens has <u>one centre</u> of curvature.
8. The straight line joining between the two centres of the lens curvature and passes through its optical centre is called <u>radius of curvature</u>.
9. The <u>focus</u> is a point inside the lens in the mid distance between its faces, the principal axis passing through it.
10. The incident ray that passes through the optical centre of the lens passes without <u>reflection</u>.
11. The incident light ray parallel to the principal axis, exits from the convex lens passing through the <u>optical centre</u> of the lens.

12. The properties of the formed images by the convex lens depend on the length of the object from the lens. *(Dakahlia 2020)*

13. When you put an object at a distance 100 cm away from a convex lens whose focal length is 50 cm. It forms an image at a distance 10 cm away from it.

14. The object that is placed at the twice of the focal length of a convex lens doesn't form an image of it. *(Suez 2015)*

15. The focal length of the thin convex lens is equal to the focal length of the thick convex lens. *(Luxor 2017)*

16. The formed image of an object that is put at the centre of curvature for a convex lens is virtual enlarged. *(Alex 2019)*

17. A convex lens of focal length 15 cm, an object was placed at 40 cm from the lens, the formed image is real and equal to the size of the object. *(Ismailia 2018)*

18. The optical piece which forms an equal, inverted image of the body is concave lens. *(Sharkia 2017)*

19. The image formed by the concave lens is always real, inverted and small (diminished) image. *(Gharbia 2017 / Luxor 2018)*

20. The clear vision for a normal vision person remains, if the object comes closer at a distance not less than 60 cm. *(Menofia 2019)*

21. Long-sightedness person can see the near objects clearly, but close objects are not seen clearly.

22. A concave lens is used to treat long-sightedness.

23. The long-sightedness is due to the formation of the image in front of the retina. *(Cairo 2017)*

24. The long-sightedness is corrected by using a concave mirror. *(Giza 2019 / Ismailia 2020)*

25. The short-sightedness is treated by using a convex lens. *(Cairo 2020)*

26. The contact lenses can stick to the eye iris and can be removed easily. *(Gharbia, New Valley 2020)*

27. Short-sightedness is a disease of the eye lens, so it becomes dark. *(Suez 2014)*

3. Write the scientific term of each of the following statements :

1. • A transparent medium refracts the light.
   • A transparent medium that refracts the light and is defined with two spherical surfaces and is usually made of glass or transparent plastic. *(Gharbia 2016 / Ismailia 2018)*

2. The transparent optical piece which is thick at the tips and thin at the middle and diverges the light rays falling on it. *(Cairo, Dakahlia 2018)*

3. The optical piece that is thick at the centre and less thickness at the tips. *(Menofia 2020)*

4. The point inside the lens on the principal axis in the mid distance between its faces. *(Behira, South Sinai 2020)*

5. Half the diameter of the sphere, where the face of the lens is a part of it. *(Qena 2018)*

6. The line joins the centre of curvature of the lens and its optical centre. *(North Sinai 2017)*

7. The straight line joining between the two centres of curvature of the lens and passing through the optical centre. *(Luxor 2019 / Assiut 2020)*

8. The midpoint inside the lens, through which light rays pass without refraction.

9. Any line passes by the optical centre of the lens except the principal axis.

10. The point of collection of the refracted light rays which is produced when the light rays fall parallel to the principal axis of a lens. *(Matrouh 2019)*

11. The distance between the focus and the optical centre. *(Giza 2020)*

12. The image which is formed due to the collection of the refracted rays and can be received on a screen.

13. The point of collection of the extensions of refracted rays by a concave lens.

14. The lens used to form a virtual, upright and always diminished image for the object. *(Matrouh 2017)*

15. • Seeing the near objects clearly and seeing the far objects distorted. *(Port Said 2016 / North Sinai 2018)*

   • A vision defect is due to the formation of the image in front of the retina of the eye. *(Menofia, Matrouh 2017)*

16. An optical piece that is used to treat a vision defect which causes the formation of image in front of the retina. *(Kalyoubia 2020)*

17. • A vision defect in the eye due to the decrease in the convexity of the eye lens surface.
   • A vision defect results due to the formation of the image behind the retina of the eye. *(Sharkia 2018 / Red Sea 2019)*

   • A vision defect results due to the decrease of the eyeball diameter. *(Minia 2020)*

18. The lens that corrects the short-sightedness.

19. The lens that corrects the long-sightedness.

20. A kind of lenses that is very thin and made of plastic and used instead of glasses and can stick to the eye cornea by the eye fluid. *(Menia 2018 / Behira 2019)*

21. The material from which the contact lenses are made.

22. A disease infects the eye lens, so it becomes dark (opaque). *(Kafr El Sheikh, Port Said 2020)*

4. Complete the following statements :

1. The .... lens is called converging lens, while the .... lens is called diverging lens.

2. ⬜ The concave lens .... the rays fall on it. *(North Sinai 2015, 2018)*

3. The convex lens .... the light, while the convex mirror .... the light. *(Dakahlia 2019 / Port Said 2020)*

4. The .... lens is thin at its centre and thick at the tips, while .... lens is thick at its centre and less thickness at its tips.

5. The focus of the lens is the point of collection of the .... light rays after .... from the lens.

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6. The point inside the lens on the principal axis in the mid distance between its faces is called .... *(Fayoum 2015 / Assiut 2018)*

7. ☐ The focal length of the convex lens equals the distance between .... and .... *(Red Sea, New Valley 2019)*

8. The double of the distance between the optical centre of a lens and its focus = ... *(Luxor 2019)*

(Behira 2018)

9. The radius of the thin lens is .... that of the thick lens.

10. The radius of the convex lens = ... of its focal length.

11. The focal length of a convex lens equals 10 cm, the radius of the curvature of the lens face is .... cm.

12. If the diameter of the sphere of a lens equals 20 cm, so its focal length equals .... *(Sohag 2017)*

13. The incident light ray that passes through the optical centre of the convex lens, it exits from the lens .... *(Suez 2015 / Giza 2016)*

14. The incident light ray parallel to the principal axis of the convex lens, it exists from it .... *(Matrouh 2016 / Gharbia 2018)*

15. An object with 6 cm height is placed at a distance 10 cm, from a convex lens, its focal length is 5 cm, therefore the height of the formed image is ....

16. If an object is put in front of a convex lens at a distance of 30 cm and its image is formed behind the lens at a distance of 30 cm, the focal length of the lens is ....

17. When the object lies in front of .... lens, a virtual and diminished image is formed. *(Assiut 2017 / Suez 2019)*

18. When an object is placed between the focus and the centre of curvature of the convex lens, the formed image is real, ... and ....

19. No image is formed for the object, when it is at the .... of the convex lens. *(Beni Suef 2018)*

20. When an object is placed at the focus of a convex lens , the rays refracts as .... *(Ismailia 2012)*

21. We use .... lens to obtain a virtual and magnified image. *(Qena 2019)*

22. The image formed by the concave lens is always .... , ... and .... *(Fayoum 2017 / Gharbia 2019)*

23. If light rays fall on the concave lens parallel to its principal axis, the rays pass through the concave lens .... as if they come from a point .... of the lens. *(Sharkia 2018)*

24. Real image is not formed by .... lenses, ... mirrors and plane mirrors. *(Minia, Ismailia 2020)*

25. It is impossible to obtain real image by using the .... lens. *(Menofia 2016)*

26. .... is used for the formation of enlarged and near images for the celestial bodies, while .... is used for the formation of magnified images of the tiny bodies.

27. The normal person can see clearly the near objects at a distance not less than .... , and far objects at a distance up to .... *(Giza 2016 / Kafr El-Sheikh 2018)*

28. From the most important vision defects are .... and .... *(Gharbia 2015)*

29. The vision defect which is due to the decrease in the convexity of the eye lens surface is called .... and is corrected by .... lenses. *(Luxor 2017 / Assiut 2020)*

30. The vision defect which is due to the increase in the convexity of eye lens surface is called .... and is corrected by using .... lenses. *(Suez 2015 / Matrouh 2018)*

31. Convex lens is used to treat some vision defects as .... *(Menofia 2018)*

32. ▢ The short-sightedness person needs a medical eye glasses with .... lenses. *(Fayoum 2018 / Port Said 2019)*

33. Correcting long-sightedness by using .... lens and correcting short-sightedness by using .... lens. *(Sohag 2019)*

34. ▢ The vision defect which is due to a shortness in the radius of the eye sphere (ball) is called .... *(Sohag, Assiut 2018 / North Sinai 2019)*

35. In short-sightedness, the images of the far objects are formed .... the retina, while in long-sightedness, the images of the near objects are formed .... the retina.

36. ▢ A long-sightedness person needs a medical eye glasses with .... lens. *(Alex., Suez 2018 / Aswan 2020)*
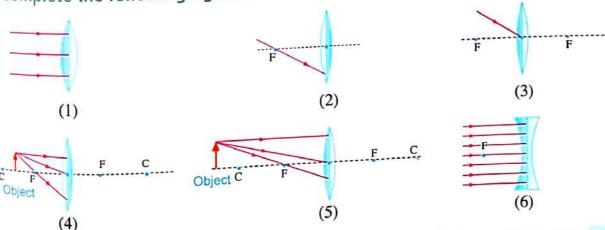
37. The contact lenses are used instead of .... and they are made of .... *(Dakahlia 2019)*

38. .... and .... are from reasons of cataract disease.

39. Treatment of cataract is done through surgery to .... the eye lens with a .... lens transplanted permanently in the eye.

40. .... scientists can be determined the heights and the distances by calculating the time of travel a beam of laser rays. *(Menia 2016)*

5. Complete the following figures :

(1)

(2)

(3)

(4)

(5)

(6)

6. Give reasons for :

1. The convex lens is called converging lens, while the concave lens is called diverging lens.
   (New Valley 2020)

2. ☐ The focal length of the thick convex lens is less than that of the thin convex lens.
   (Menia 2018)

3. The lens has two centres of curvature.   *(Kafr El-Sheikh 2018 / Ismailia 2019)*

4. • ☐ The collective lens has two foci, but the collective mirror has one focus.
   (Kalyoubia 2016 / Sharkia 2017)

   • The lens has two foci, while the spherical mirror has one focus.
   (Dakahlia 2019 / Sohag 2020)

5. ☐ The object that is placed at the focus of a convex lens has not an image.
   (Assiut, Aswan 2020)

6. A piece of paper can be burned by a convex lens.

7. • The image formed by the concave lens cannot be received on the screen.   *(Dakahlia 2020)*
   • It is impossible to obtain a real image by using a concave lens.   *(New Valley 2019)*

8. Concave lens has a virtual focus.   *(Beni Suef 2016)*

9. Vision defects occur.

10. Short-sightedness person sees the far objects distorted.

11. Some persons have short-sightedness.   *(Cairo, Matrouh 2019)*

12. In short-sightedness, the retina is far from the eye lens.

13. ☐ Concave lens is used to correct short-sightedness person.   *(Behira, Dakahlia 2019)*

14. Occurrence of long-sightedness of the person.   *(Dakahlia 2016)*

15. Long-sightedness person cannot see the close objects clearly.   *(Cairo 2020)*

16. The retina is close to the eye lens in the long-sightedness person.

17. The image of the near objects are formed behind the eye retina in the long-sightedness.

18. ☐ The long-sightedness is corrected by using a convex lens. *(Aswan 2018 / Beni Suef 2020)*

19. ☐ The infection of the eye with the cataract.   *(Ismilia 2018 / Port Said 2019)*

7. Define each of the following :

1. The lens.   *(Behira 2016)*

2. The concave lens.

3. The convex lens.

4. The focus of the convex lens.   *(Assiut 2017 / Sohag 2020)*

5. The centre of curvature of the lens face.

6. The optical centre of the lens.   *(Cairo 2019 / Beni Suef 2020)*

7. The principal axis of the lens.   *(Cairo, Damietta 2017)*

8. The principal focus of the lens.   *(Cairo 2016)*

9. The focal length of a lens.   *(Giza 2019)*

10. Short-sightedness.

11. Long-sightedness.

12. Contact lenses.

13. Cataract disease.

8. What is meant by ... ?

1. The focal length of a convex lens is 15 cm.

   (Ismailia 2014 / Assiut 2020)

2. The distance between the optical centre of a convex lens and its focus is 10 cm.

   (Luxor 2014)

3. The radius of curvature of a concave lens is 20 cm.

   (Qena 2019)

4. The image formed by the lens may be real or virtual.

5. The image formed by the concave lens is virtual.

   (Behira 2015)

6. A person suffers from short-sightedness.

7. A person suffers from long-sightedness.

   (Gharbia 2015)

9. State one function (importance) for each of the following :

1. The convex lens (in eye's medicine field).

   (Kafr El-Sheikh 2017)

2. The concave lens.

3. The contact lenses.

   (South Sinai, Ismailia 2019)

4. Space telescope.

   (Luxor 2017)

10. When do the following cases occur ... ?

1. The length of the image equals the length of an object that is put in front of a convex lens.

2. Formation of a virtual, upright and diminished image in the lens.

3. The person suffers from short-sightedness.

   (Suez 2019)

11. What happens when ... ?

1. The radius of curvature of the face of the lens increases twice (concerning the focal length).

2. You move a screen closed and farther from a convex lens, when its other side is facing to a light source.

3. Concentrating sunlight by a magnifying lens on a piece of paper.

4. A light ray passes through the optical centre of the lens.   *(Port Said 2019 / Aswan 2020)*

5. A light ray is incident parallel to the principal axis of the convex lens.   *(Suez 2017 / Alex 2019)*

6. A light ray passes through the focus of the convex lens.   *(North Sinai 2015 / Cairo 2020)*

7. An object is put at the focus of a convex lens.   *(Qena 2019 / Kalyoubia 2020)*

8. An object is put at a distance equals to the double of the focal length of a convex lens.

   (Luxor 2019)

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9. You want to see a virtual, erect and magnified image of an object through a convex lens.

10. Incidence of a beam of light rays parallel to the principal axis of a concave lens. *(Red Sea 2018)*

11. An object is put in front of a concave lens. *(Kafr El-Sheikh 2019)*

12. The eye lens surface in man is too (more) convex. *(Ismilia 2018)*

13. The eye lens surface in man is less convex. *(Red sea 2018 / Ismailia 2019)*

14. • The length of the eye radius is larger than the normal. *(Cairo 2016 / Matrouh 2019)*
    • The diameter of the eyeball elongates. *(Fayoum, New Valley 2019)*

15. • The diameter of the eyeball becomes shorter than a certain length. *(Kafr El-Sheikh, Fayoum 2017 / Matrouh 2018)*

    • The shortness of the radius of the eyeball. *(Fayoum 2018)*

16. The infection of the eye with the cataract disease. *(Ismailia 2015 / Luxor 2018)*

12. Show by drawing, the path and the directions of rays in the following cases :

1. The incident light ray passing through the optical centre of the lens.

2. The incident light ray parallel to the principal axis. *(Port Said 2014)*

3. The incident light ray passing through the focus.

4. • A body is put in front of a convex lens at a distance of 30 cm, knowing that its focal length is 15 cm.

    • The formed image by a convex lens to an object at a distance equals twice the focal length (at the centre of curvature of a convex lens). *(Sohag 2014 / Qena 2016)*

    • 📖 The formation of an image equals to the object by means of a convex lens. *(Aswan 2018)*

5. • The formation of the image of a body is placed at a distance smaller than the focal length of a convex lens then mention the properties of the formed image. *(Damietta 2020)*

    • The eye sees the image of the object which is placed at a distance of 8 cm from a convex lens has a focal length = 12 m, then mention the properties of the formed image. *(Matrouh 2018)*

6. An object is put at the focus of the convex lens.

7. • The formed image by a convex lens to an object at a distance larger than the focal length and smaller than twice the focal length (mention the properties of the image). *(Sharkia 2014 / Giza 2017)*

    • The formed image for an object located in front of a convex lens between the focus and centre of curvature. *(Damietta 2019)*

    • An object is placed at a distance of 30 cm from the convex lens, its focal length 25 cm (mention the properties of the image). *(Minia 2016)*

8. • An object was placed at a distance of 5 cm from a convex lens, its focal length is 2 cm (mention the properties of the image). *(Beni Suef 2018)*

    • The formed image by convex lens, when the body at a distance greater than double the focal length. Then write the properties of the formed image. *(Cairo 2019 / Port Said 2020)*

9. • The eye sees the image of an object which is placed at a distance of 8 cm from a concave lens has a focal length 2 cm (mention the properties of the image).

(Behira 2016)

• The image is formed for an object put in front of a concave lens (mention the properties of the image).

(Qena 2018)

10. The type and the role of lens used to correct the short-sightedness.

11. Correction of long-sightedness.

13. Mention the position and properties of the formed image of an object by means of a convex lens in each of the following cases :

1. The object is at a distance greater than the double of the focal length.

2. ⊡ The object is at a distance equals to twice the focal length.

3. ⊡ The object is at a distance greater than the focal length and smaller than twice the focal length.

4. The object is put at a distance less than the focal length. *(Sharkia 2020)*

14. Compare between :

1. Lenses and spherical mirrors (concerning the defination). *(Giza 2018)*

2. Convex lens and concave mirror (concerning : the image formed when the object is placed at a distance less than the focal length). *(Sharkia 2018)*

3. Convex lens and concave lens. *(Fayoum 2014)*

4. The focal length of the thick convex lens and the thin convex lens. *(Assiut 2017)*

5. Principal axis of the mirror and that of the lens. *(Fayoum 2015)*

6. The properties of the formed image by a convex lens and a concave lens for an object is put between the focus and the centre of curvature. *(Beni Suef 2014)*

7. The falling of the parallel Sun rays, parallel to the principal axis on each of a convex lens and a concave lens. *(Ismailia 2017)*

8. The principal focus of a concave mirror and the principal focus of a concave lens (according to definition only). *(Dakahlia 2016 / Luxor 2017)*

9. Long-sightedness and short-sightedness concerning :

   • Definition.

   • The cause of each one.

   • The position of the formed image.

   • The type of lens used in correction of each one.

   (New Valley 2018 / Alex 2019)
   (South Sinai 2018 / Luxor 2019)
   (Sohag 2019, 2020)
   (Alex, Luxor 2019)

15. Show an activity for the determination of the focal length of the convex lens.

(Menofia 2016 / Minia 2018)

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16. Show by drawing and write the labels how to obtain the following images by using a lens, then mention the type of this lens :

1. A virtual enlarged image.

2. A virtual diminished image.

(Dakahlia 2016)

17. Various questions :

1. Mention the most important uses of the lenses.

2. Mention the types of lenses.

3. Mention the function or importance of :

(Cairo 2016)

(a) Telescope.

(b) Microscope.

(c) The contact lenses.

(Red Sea 2016, 2018)

4. A convex lens with a focal length of 10 cm, an object was placed at a distance of 20 cm from the lens. Assign the distance of the object image from the lens and mention its properties.
(Kafr El-Sheikh, Behira 2017 / Sohag 2020)

5. An object is placed at a distance of 5 cm from a convex lens, its focal length is 3 cm. show by drawing the position of the formed image and mention the properties of this image, by drawing two light rays only.
(Behira 2019)

6. A body is placed at a distance 8 cm from surface of the convex lens which is made of two surfaces of spheres, the diameter of each sphere is 16 cm.

(a) Show by drawing the distance between the object and its image.

(b) Calculate this distance.

(c) Write the properties of the image.

7. A body whose length is 4 cm at a distance of 6 cm from a convex lens, its focal length is 3 cm. Draw a diagram to show the path of the rays falling on the lens and the refracted ones from it, then mention :
(Beni Suef 2016 / North Sinai 2017)

(a) The properties of the image formed.

(b) The length of the image.

(c) The radius of curvature of the lens.

(d) The position of the image.

8. A body at a distance of 6 cm from a convex lens of focal length 4 cm.
(Suez 2016, 2017)

(a) Draw the path of rays formed the image.

(b) Determine the position of the image.

(c) Mention the properties of the image (three properties).

(d) Calculate the radius of the lens.

9. A body of length 3 cm is put in front of a convex lens its focal length is 4 cm and diminished image is formed, in this case, **Choose the correct answer :** *(Suez 2018)*

 (a) The body placed at a distance of (4 cm / 5 cm / 8 cm / 9 cm) from the optical centre of the lens.

 (b) The image is formed at a distance of (4 cm / 5 cm / 8 cm / 9 cm) from the optical centre of the lens, and its length equals (1 cm / 3 cm / 4 cm / 6 cm).

 (c) From the properties of the image formed are :
 (Real and inverted / Virtual and inverted / Real and upright / Virtual and upright)

10. A lens is placed in front of Sun rays, a very small real image for the Sun is formed at a distance 20 cm from the optical centre of the lens.

 (a) What is the type of the lens and what is the value of its focal length ? *(Luxor 2015)*

 (b) Mention the position and the properties of the image formed for an object is placed at a distance 10 cm from the optical centre.

 (c) If this lens is used to form real, inverted and enlarged image for a body. Show this by drawing.

 (New Valley 2017)

11. An object is put at a distance of 4 cm. from the optical centre of a lens. *(Dakahlia 2020)* A (real-magnified) image is formed for the object and when the object moved a distance of 2 cm away from the lens. a (real - equal to the object) image is formed.

 (a) What is the kind of the lens ?

 (b) Draw the path of the rays that formed the image when the object was a distance of 4 cm from the optical centre of the lens ?

 (Suez 2019)

12. An object is placed at 10 cm from the optical centre of the lens, then a real diminished image for the object is formed. And when the object is moved to 4 cm towards the lens a real and equal image of it is formed. *(Menofia 2020)*

 (a) What is the type of the lens ? *(Matrouh 2015)*
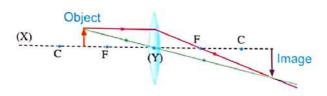
 (b) How long is the focal length of the lens ?

 (c) Draw a diagram showing the path of rays in the second case.

13. Show by drawing only the position of focus in the convex lens.

14. Mention briefly the reasons for short-sightedness and how to correct it. *(Dakahlia 2018)*

15. Mention briefly the reasons for long-sightedness and how to correct it.

16. Two friends, Ahmed and Ali were reading at the school library. Ahmed noticed that his friend was reading only books which are far from his eyes. *(Dakahlia 2020)*

 (a) What's the vision defect with Ali ?

 (b) How can you correct this defect ?

17. The doctor examines Ahmed's eyes, then he finds out that he suffers from short-sightedness, he advised him to use glasses. *(Damietta 2016)*

 (a) What is meant by short-sightedness ?

 (b) What is the type of lenses which the doctor advised to use ?
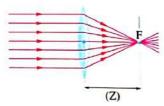
18. One of the students approaches a lens to one of his eyes and looks through it, he observes that the image for the object seem erect. After the lens becomes far to a certain distance from one of his eyes he observed that the image for the object seems inverted.
The student concludes that the lens must be a convex lens.

   (a) Is the conclusion of the student correct or incorrect ?

   (b) Explain your answer.

19. Determine the type of the optical piece (lens or mirror) then mention its type (concave or convex or plane) when it is able to:

   (a) Form a virtual upright minimized image in the same side of the object, whatever its distance of it.

   (b) Form a virtual upright enlarged image on the other side of the object, only if the object placed at a distance less than its focal length. *(Menofia 2020)*

18. Study the following figures, then answer the questions :
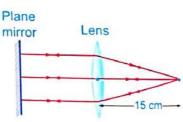
1. In the following figures, label the points (X) , (Y) and (Z).

2. In the opposite figure :

   (a) What is the kind of this lens ?

   (b) The focal length = ...

   (c) The distance between the centre of curvature and the optical centre of the lens = ...

3. In the opposite figure :

   Which of the rays ❶ , ❷ *or* ❸ can :
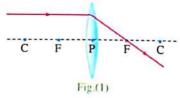
   (a) Pass without refraction ? Why ?

   (b) Refract passing through the focus ? Why ?

   (c) Refract parallel to the principal axis ? Why ?
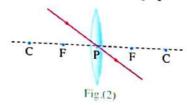
   (Ismailia 2015 / Menofia 2018)
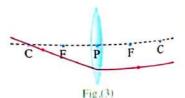
4. Examine the following figures, then :
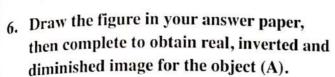
   (a) Mention the figure number which is incorrect "Give a reason".

   (b) Redraw the figure after correction in your sheet paper.

Fig.(1) Fig.(2) Fig.(3)
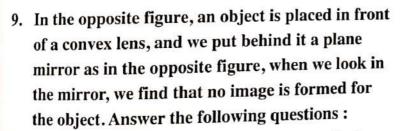
5. 📖 A convex lens, its focal length equals 4 cm. An object is placed at a distance of 6 cm from the lens. Determine the position of the formed image and its properties by drawing only two light rays. *(South Sinai, Fayoum 2019)*

6. Draw the figure in your answer paper, then complete to obtain real, inverted and diminished image for the object (A).

(Assiut 2017)
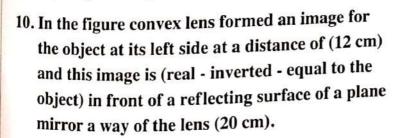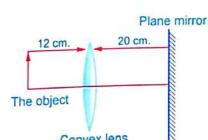
7. Draw the opposite figure in your answer paper, then : *(Port Said, Gharbia 2018)*

(a) Compelete the figure to obtain an image for the object.

(b) Mention the properties of the formed image.

8. Draw the opposite diagram in your answer paper, then :

(a) Complete the path of the rays to form an image for the object.

(b) Determine the position of the formed image from the figure. *(Ismailia 2016 / Beni Suef 2020)*

9. In the opposite figure, an object is placed in front of a convex lens, and we put behind it a plane mirror as in the opposite figure, when we look in the mirror, we find that no image is formed for the object. Answer the following questions :

(a) Mention the position of the object from the lens.

(b) Why no image is formed for the object inside the mirror ? *(Kalyoubia 2016)*

10. In the figure convex lens formed an image for the object at its left side at a distance of (12 cm) and this image is (real - inverted - equal to the object) in front of a reflecting surface of a plane mirror a way of the lens (20 cm).
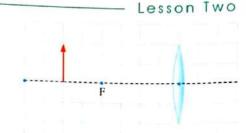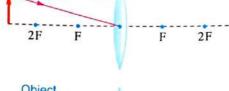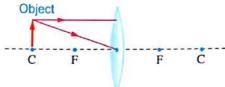
Conclude each of the the following :

(Menofia 2019)
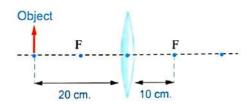
(a) Focal length of the convex lens.

(b) The distance between the object and the formed image by the plane mirror ?
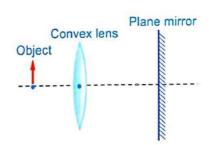
Is the image upright or inverted for the object?

Scanned with CamScanner
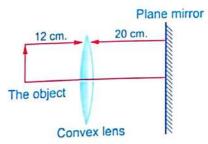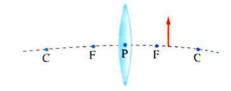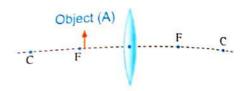
11. Copy the opposite figure in your answer paper, then draw the direction of the rays which form the image of the body and mention the properties of the formed image. *(Fayoum 2017 / Gharbia 2020)*

12. (a) Copy the opposite figure to your answer paper, then complete it to get an image for the object (A) and mention its properties.
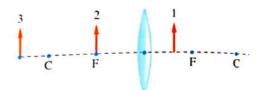
    (Assiut, Ismailia 2019)

Object (A)

   (b) What happens if the object is moved and placed at the principal focus of the lens ?

    (Menofia 2018)
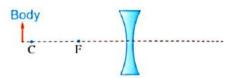
13. From the opposite figure in which position from 1, 2 or 3 is suitable to put the object to form :

   (a) Real, inverted and diminished image.

   (b) Virtual, upright and enlarged image at the same side of the object.

   (c) No image.   *(Ismailia 2020)*
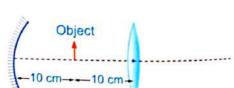
14. Draw the opposite diagram in your answer paper, then determine the position and the properties of the formed image by drawing only two light rays.

Body

    (Alex. 2019 / Red Sea 2020)

15. In the opposite figure, an object is placed between a convex lens whose focal length is 5 cm and a concave mirror whose focal length is 5 cm.   *(Kalyoubia 2015)*
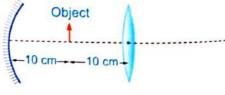
   (a) Find the distance between the image formed by the convex lens and the image formed by the concave mirror.

Object

$\leftarrow$10 cm$\rightarrow\leftarrow$10 cm$\rightarrow$
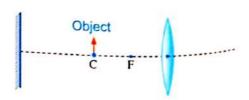
   (b) Mention the properties of the image formed by the concave mirror.

16. In the figure shown, an object is placed at the centre of curvature of one face of a convex lens of focal length 6 cm. Then, a plane mirror is placed at the other side of the object at 8 cm from the object. Copy the diagram in your answer sheet and answer :

    (Kalyoubia 2019)
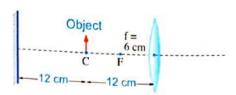
   (a) Draw the path of light rays incident on the lens to form an image on a screen in front of the lens.

Object

   (b) Calculate the distance between the two images formed by the lens and the mirror.

17. **Look at the opposite figure, then complete the following statements :**

   (a) The distance between the image of the object which is formed by a plane mirror and its surface equals .... cm.

   (b) The distance between the image of the object which is formed by a convex lens and the lens equals .... cm.

   (c) The distance between the image of the object which is formed by a convex lens and the image which is formed by a plane mirror equals .... cm.

   (Damietta, New Valley 2020)

18. **From the opposite figures compare between the two lenses according to the focal length.**
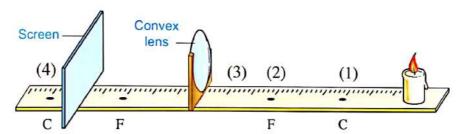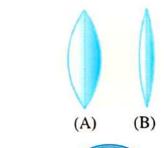
   (Port Said 2015 / Beni Suef 2019)

19. **In the following figure :**
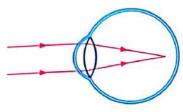
   (a) What are the properties of the image of the candle which is formed on the screen ?

   (b) Mention the position at which the candle must put to make its image cannot be received on the screen.

   (c) When the candle is moved to the position (1), the screen must be moved to the position .... to receive the image.

20. **In the opposite figure, two eye lenses for two different persons. Which of them has short-sightedness and why ?**

21. **The opposite figure represents a vision defect :**

   (a) What is the type of this defect in this eye ?

   (b) What is the type of the lens used to correct this defect ?

   (Qena 2015)

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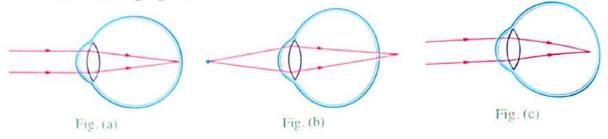
22. The opposite figure represents a vision defect :

(a) What is the type of this defect in this eye ?

(b) What is the type of the lens used to correct this defect ?
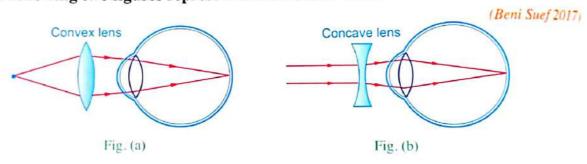
(c) How does the eye see the near and far objects ?

23. From the following figures :

Fig. (a)

Fig. (b)

Fig. (c)
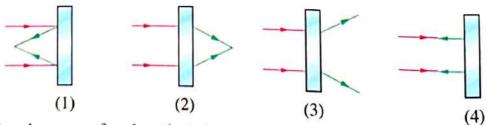
(a) Which figure represents a normal eye ? Why ?

(b) In the previous figures, which case can be treated by a convex lens ? Why ?

24. The following two figures represent the treatment of the vision defects :

(Beni Suef 2017)

Convex lens

Concave lens

Fig. (a)

Fig. (b)

(a) Mention the vision defect in each figure.

(b) Where was the image formed before using the lens in each case ?

25. The following figures contain rectangles which represent different optical pieces :

(1)　　　(2)　　　(3)　　　(4)

(a) Mention the name of each optical piece.

(b) Redraw these figures with the replacement of each rectangle by the optical piece which represents it.

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Timss Questions

1. Choose the correct answer :

1. A board with the letter L on it, is put at a distance of 40 cm at the left side of a convex lens. Then the formed picture .... received on a screen which is at a distance of 60 cm at the right side of the lens.

   a. ⌐   b. L   c. ⊤   d. Γ
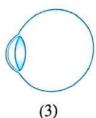
2. The ratio between the length of the body to the length of its image formed by the concave lens is .... one.

   a. more than   b. less than   c. equal to   d. no correct answer

3. In the opposite figure, if this optical glass piece painted from one side with silver metal : the incident light ray which falling as shown, will undergo ....

   a. refraction only.

   b. reflection only.

   c. reflection then refraction only.

   d. refraction then reflection then refraction.

4. If you put an object (A) in the centre of curvature of a convex lens, and a plane mirror in its centre of curvature of the other side, so the image formed by the plane mirror with respect to the object (A) is ....

   a. upright and equal.

   b. upright and diminished.

   c. inverted and equal.

   d. inverted and magnified.
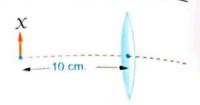
2. If a light ray passes through the optical centre of a convex lens, by using a plane mirror explain how can you reflect this light ray on itself without being refracted.

3. In the following figures :

    (1)   (2)   (3)

(1) Which figure represents a normal eye ? Why ?

(2) Which case can be corrected by a convex lens ? Why ?

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4. The opposite figure shows an object (X), its length is 3 cm and it puts in front of a convex lens, its focal length is 4 cm.

X

$\longleftarrow$ 10 cm. $\longrightarrow$

Answer the following questions :

(1) Draw two rays emergent from object (X), by which they the position of the image formed by the lens can be determined.

(2) What are the properties of the formed image ?

(3) What is the result of approaching the object from the lens 2 cm on each the length of the image formed and its distance from the lens ?

(4) By continuous approaching the object from the lens, no image is formed. Explain why ?

(5) What are the properties of the formed image for the object, if it becomes at a distance 2 cm from the lens ?

5. Complete the following :

Both .... and .... can form a virtual and diminished image for an object at any distance from it, while both .... and .... can form a real and diminished image for an object at a distance greater than its radius of curvature.

Project.
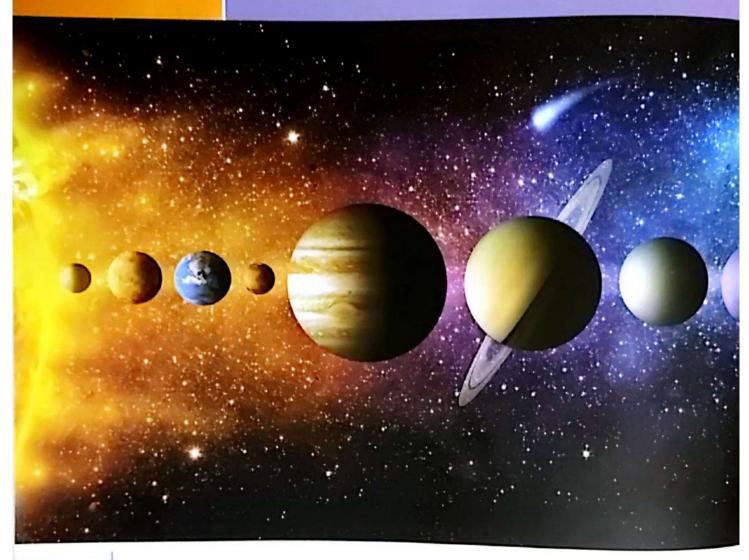
A project to develop the creative thinking
"Analysis of creative designs"

* "Creators notice the design of creatures which God create, and the designs which are made by man". Develop your sense of creation by concentrating in the designens of lenses and mirrors, through answering the following questions :

1. Why dentists and car designers use concave mirrors ?

2. Why it is not easy to read a book through looking at a plane mirror ?

3. Why convex lenses are different from each others ?

4. Why the concept of the optical center of a lens, is crossponding to the concept of the pole of a spherical mirror ?

5. Why the use of a concave lens is differ from the use of a convex mirror ?

6. Why the image formed by the plane mirror cannot be received on a screen ?

7. Why there are no real images formed behind the mirrors ?

8. Why we use a light box in the activity that determine the radius of curvature of a mirror ?

9. Why there is one focus for the spherical mirror and two focci for the lens ?

10. Why the type of contact lens differs from one person to another ?

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The Universe and the Solar System

Lesson of the unit :

The Universe and the Solar System.

▶ Unit Objectives :

By the end of this unit, students will be able to :

- Identify the components of the universe.

- Identify the galaxies.

- Determine the location of the solar system in The Milky Way galaxy.

- Identify some theories of cosmogony.

- Identify some theories of the evolution of the solar system.

- Identify the rotation of the solar system around the centre of the galaxy.

- Appreciates the greatness of Allah in the creation of the universe.

The Universe and the Solar System

What is meant by the universe ?

- The vast universe is filled with millions of stars.
- Everything changes in the universe, where :
  - Stars always change.
  - Galaxies get away from each other very fast, so the universe is in a state of continuous expansion.

The universe

It is the wide and extended space that contains all the galaxies, stars, planets, moons, living organisms and everything.

- The universe is very vast.
- The Sun and the Earth are tiny parts in the universe.
- The universe contains about 100 000 million galaxies.

The galaxies :

Galaxies

- They are groups of stars that rotate together in cosmic space by the effect of gravity.
- They are the greatest units that form the universe.

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- Each galaxy has a distinctive shape according to the harmony and order of the groups of stars in it.
- Galaxies gather in groups called clusters.

Andromeda galaxy   Scorpion galaxy   Ursa Major galaxy

For illustration

Galaxies clusters

They are groups of galaxies that rotate together in cosmic space by the effect of gravity.

- The galaxy to which our solar system belongs is "Milky Way galaxy".

Galaxies clusters

GR. | *The Milky Way galaxy is given that name.*

Because it appears in the sky at night as a splashing milk or spreading straw.

The Milky Way galaxy :

- It is considered one of the spiral galaxies.
- It contains all stars we see at night in the sky.
- The Sun is a star of millions of stars that rotate around the centre of Milky Way galaxy in fixed orbits.
- In Milky Way galaxy :
  The old stars (the older) gather in the centre surrounded by the small stars (the recent age) are located in the spiral arms of the galaxy.

Milky Way galaxy
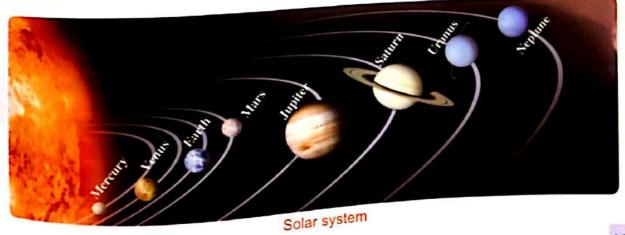
The solar system

The solar system
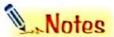
It contains the Sun and eight planets revolving around the Sun.
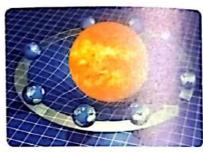
Solar system

Mercury Venus Earth Mars Jupiter Saturn Uranus Neptune

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- The solar system is located in one of the spiral arms of the Milky Way on the edge of the galaxy.

- The Sun takes about 220 million years to complete one rotation around the centre of the galaxy.

- The Earth is one of the planets that rotate around the Sun.

Top view

The Sun — Centre of the galaxy — Arms of the galaxy

Lateral view

Position of the Sun in the Milky Way galaxy

Notes

• The force of gravity is responsible for keeping the planets in their orbits around the Sun and the moons in their orbits around planets.

• As the distance between the Sun and the planet increases, the gravity decreases and its movement around the Sun becomes slower.
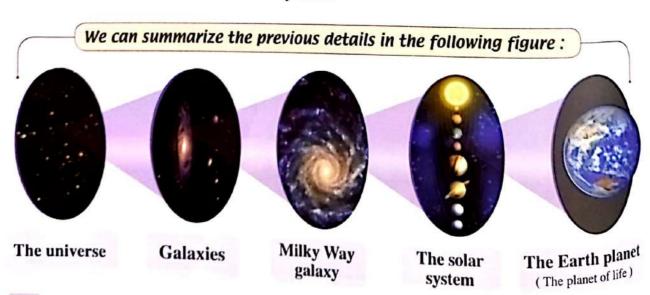
The Earth rotates in a fixed orbit by the effect of the Sun gravity

What happens if ... ?

The gravity between the planets and the Sun is vanished.

➲ The planets will leave their orbits and float in a random fashion in space and therefore there will be no solar system.

We can summarize the previous details in the following figure :

The universe   Galaxies   Milky Way galaxy   The solar system   The Earth planet (The planet of life)

Measuring the distances between the celestial bodies in the universe :

The distances between celestial bodies (stars) are very large, so the distances in the far space are not measured in kilometres, but they are measured in a unit called "Light year".

GR. | **Astronomers don't measure the distances between stars in kilometres.**
Because the distances between stars are very large.

Light year

It is the distance covered with light in one year and it equals 9.46×10^{12} km.

For illustration

The speed of light equals 300 000 km/sec. so, the distance covered with light in one year
= 300 000 × (365 days × 24 hours × 60 min. × 60 sec.) = 9460800 million km
$$= 9.46 \times 10^{12} \text{ km.}$$

What is meant by ... ❓

The distance between the Sun and a certain star is three light years.

⮕ This means that the distance between the Sun and this star = $3 \times 9.46 \times 10^{12}$
$$= 28.38 \times 10^{12} \text{ km.}$$

Expansion of the universe

Distances between galaxies increase as time passes, as galaxies move away from each other in the cosmic space. This phenomenon is known as "Expansion of the universe".

🧪 **Activity** — To show the expansion of the universe and separation (or spacing) of galaxies.
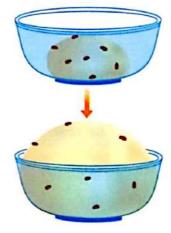
▶ **Tools :**
- Warm water.
- Bread yeast.
- Flour.
- Glass container.
- Raisins.

▶ **Steps :**
- Mix some flour and some of bread yeast with warm water well in the glass container to make bread dough.
- Insert some raisins on the surface of the dough.
- Leave the dough to ferment in a warm environment.

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▶ *Observation :*

When the dough expands, the grains of raisins become apart (away) from each other as time passes.

▶ Conclusion :

If we consider the dough represents the universe and the grains of raisins represent the galaxies, **So** :

Swelling of the dough	**resembles**	Expansion of the universe.
Separation of the grains of raisins	**represents**	Separation of the galaxies from each other in the universe.
Increasing the distances between grains of raisins as time passes	**means**	The continuous expansion of the universe.
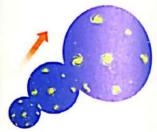
Expansion of the universe as time passes

○ **From the previous activity, we can define the expansion of the universe as follows :**

Expansion of the universe

It is the continuous separation between galaxies in space as a result of their regular movement.

G.R. | *The continuous expansion of the space (universe).*

Due to the movement of galaxies apart.

❓ Exercise 1

Complete :

(1) The building unit of the universe is ....

(2) The solar system contains a number of .... *revolve around the Sun.*

Answer

(1) galaxy.

(2) 8 planets

The origin of the universe

How did the universe originate ... ?

➔ There was no one to relate what happened. But the discoveries in physics and astronomy enabled scientists to trace the history of the universe from the first second fraction of its evolution.

➔ Many scientists believe that the universe emerged from a massive explosion called Big Bang.

The Big Bang theory [1933] :

* **The Big Bang theory assumed that :**

• **The beginning of the universe** was a gaseous ball of high pressure, high temperature and small in volume.

• **A massive explosion occurs** to this ball since **15000 million years** and its components were scattered in space followed by continuous expansion and changing processes till now.

• **Resulted from this explosion,** all forms of matter, energy, space and time.

Imaginary picture
of the Big Bang

○ **From the previous explanation, we can define the Big Bang as follows :**

Big Bang

It is a theory that explains the origin of the universe from a massive explosion since 15000 million years and resulted in it all forms of matter, energy, time and space followed by continuous expansion and changing processes.

✷ **The following table shows stages of the origin of the universe since the moment of Big Bang :**
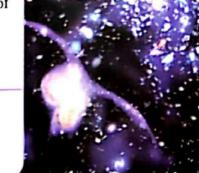
1 Through Big Bang:

The gaseous ball from which the universe originated exploded and the process of expansion and changing started.

2 Within minutes after the explosion:

- The temperature becomes about 10 000 million degrees.
- The atomic particles produced from explosion merged together producing gaseous clouds of hydrogen and helium with a percentage of 75% : 25% respectively.
- These gases produce the galaxies, stars and universe through millions of years.

3 After about 1000 million years:

The previously formed matter merged in the form of **masses**.

4 After about 2000 : 3000 million years:

Gravity helped in gathering more masses forming "Ancestral galaxies" leaving areas of empty space between them.

5 After about 3000 million years:

Galaxies began to form.

6 After about 5000 million years:

Our galaxy, the Milky Way, took its disc form.

7 After about 10000 million years:

- The Sun was born.
- Then the Earth and planets were created.

8 After about 12000 million years:

Earliest life forms began to appear on the Earth.

9 After about 15000 million years:

The universe is as it is now.

▶ **Enrichment information**

• In 1964, scientists Robert Wilson and Arno Pinzias coincidently discovered radio waves coming from space.

• They concluded that these waves are a type of the echo coming from the Big Bang which still frequented in the universe.

- TV sets can receive such signals (waves) on the Earth.

- These scientists have won the Nobel prize for physics in recognition of the discovery.

Robert Wilson and Arno Pinzias

TRY to answer worksheet **11** in the Notebook

Theories about the evolution of the solar system

- There are many scientific and philosophical theories about the evolution of the solar system. They are about twenty theories.

- These theories are still unproved and subjected to change (as we shall see).

❋ **We will study the most important theories about the evolution of the solar system, which are :**

1	**2**	**3**
The Nebular theory [Laplace].	**The Crossing star theory** [Chamberlain and Moulton].	**The Modern theory** [Fred Hoyle].

1 The Nebular theory : [Laplace 1796] :
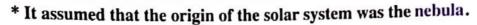
Later, in 1796, the French scientist Pierre Simon Laplace published a research entitled "World order".

- This research included a perception of Laplace about the evolution of the solar system.

- This perception (which won a great reputation for a century) has been affected by **two observations**, which are :

1. There is something that looks like clouds or nebula in the space.

2. The space contains many cloudy rings surrounding some planets such as the rings of Saturn planet.

Rings of Saturn planet

المعاصر علوم لغات (شرح) / ٣ع / ترم ١ (م ١ : ٢٦)

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Assumptions of nebular theory :

* It assumed that the origin of the solar system was the nebula.

⊙ The three phases of nebular theory :

| First | The solar system originated from a glowing gaseous sphere revolving around itself, this sphere is called (nebula). | |
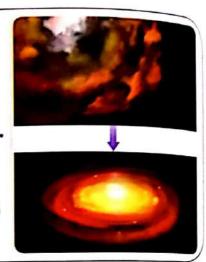
The contraction of nebula (gaseous sphere) :

▶ Over the time, the nebula lost its heat gradually, so its size contracted and its revolving speed around itself (axis) increased.
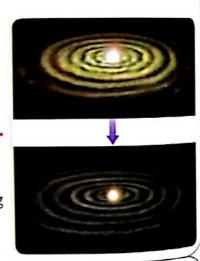
| Second | The centrifugal force arising from the rotation of nebula around its axis led to :
▶ a. The nebula lost its spherical shape and became in a form of a flat rotating disk. | |

Formation of the gaseous rings :

▶ b. Separation of parts of nebula in the form of gaseous rings that also rotate around the remaining flaming mass from it and in the same direction.

| Third | ▶ The gaseous rings cooled down and frozen forming the planets of the solar system, while the flaming mass that is remained in the centre formed the "Sun". | |

Formation of the solar system :

○ From the previous explanation, we can define the nebula as follows :

Nebula
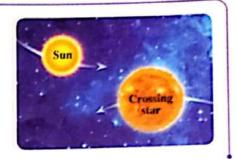
It is a glowing gaseous sphere revolving around itself, from which the solar system was originated.

2 The Crossing star theory : [Chamberlain and Moulton 1905] :

Assumptions of the crossing star theory :
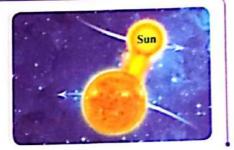
It assumed that the origin of the solar system was a big star which is the Sun.
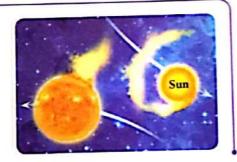
1 Another huge star (crossing star) approached the Sun.

2 This star attracted the Sun to it, leading to a great expansion in the part of the Sun facing it.
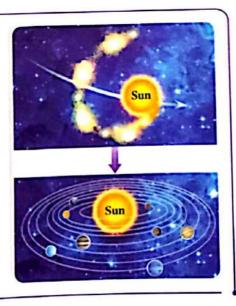
3 **The expanded part from the Sun was exploded leading to :**
- The Sun escaped from the gravity of that star.
- A gaseous line was formed of a great length from the Sun until the last planets (which will be formed later).

4 The gaseous line started to condense **due to** the attraction force, then it cooled forming the planets.

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3 The Modern theory of the world : [Fred Hoyle 1944] :

Fred Hoyle builts his theory on the origin of the solar system on the basis of well-known astronomical phenomenon known as "Stars explosion phenomenon".

Stars explosion phenomenon :

Stars explosion phenomenon

Glowing of a star for a short time to become one of the most shining stars in the sky, then its glowing disappears gradually to return as it was.

- The interpretation of this phenomenon is not known specifically until now.

The following is an attempt to interpret this phenomenon :

1 Sudden violent nuclear reactions occur within the star which led to its explosion.

2 The star bombs huge amounts of gaseous materials as a result of this explosion which led to increasing its size and its shining.

Explosion of stars

3 When the bombed gases are cooled, the shining of the star returned as it was.

Exercise 2

Choose :

(1) The scientist(s) who established the crossing star theory is/are ....
   a. chamberlain and Moulton.
   b. Laplace.
   c. Newton.
   d. Fred Hoyle.

(2) In the modern theory, bombing the star nucleus away was due to ....
   a. the force of gravity.
   b. collision by asteroids.
   c. drop in temperature.
   d. huge nuclear reactions.

Answer
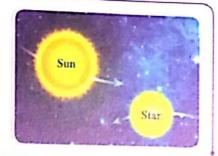
(1) a.   **(2) d**

Assumptions of modern theory (Fred Hoyle) :

. It assumed that the origin of the solar system was a **star rather than the Sun.**

1 A star was rotating near the Sun.

2 The star exploded due to huge **nuclear reactions.**

3 **The force of the explosion led to :**
- The bombing of the star's nucleus away from the gravity of the Sun.
- A gaseous cloud from this star remained around the Sun.

4 The gaseous cloud subjected to cooling and contraction processes forming the matter of planets, then the attraction force of the Sun controlled the orbits of planets around it.

GR | *Explosion of some stars suddenly.*
Due to occurrence of sudden and violent nuclear reactions.

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Science, Technology and Society

The important instruments to study the outer space :

The solar telescope

Astronomers use special equipments centered on the Earth as the solar telescope or carried into space as Hubble telescope in order to study the Sun.

Importance of solar telescope :

It forms a complete picture for the Sun.

How does the solar telescope work ... ?
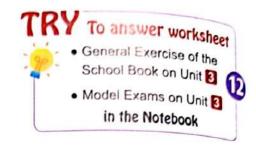
- ⊃ It works on reflecting the Sun rays downward to a concave mirror in a tunnel under the Earth's surface.

- ⊃ The sunlight is gathered, then separated into a solar spectrum by the spectrometer (this shows the different light wavelengths emitted by the Sun).

Internal structure of solar telescope

- ⊃ A complete picture of the Sun is formed in a monitoring room where astronomers can study its light.

- ✳ Astronomers got most of their information about the Sun from the study of its spectra.

Solar telescope
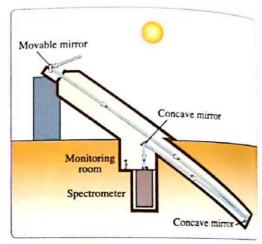
The Hubble telescope :

- ⊃ The Hubble telescope was launched in April in 1990
- ⊃ It rotates around the Earth at a height of 500 km.

Importance of Hubble telescope :

It collects photos for the universe that give us details about its state since millions of years, these photos give astronomers an opportunity to study the evolution of the universe after the Big Bang.

Hubble telescope

? Exercise 3

Write the number that represents each of the following sentences :

(1) The nearly number of galaxies that is present in the universe. (........)

(2) The number of planets that revolve around the Sun. (........)

(3) The number of years that is needed for the solar system to make one rotation around the centre of Milky Way galaxy. (........)

(4) The number of kilometers that the light travels in one second. (........)

(5) The number of kilometers that the light travels in one year. (........)

(6) The number of years since the universe is originated. (........)

(7) The temperature that becomes within minutes of the Big Bang explosion. (........)

Answer

(1) 100000 million

(2) 8

(3) 220 million

(4) 300000

(5) 9.46×10^{12}

(6) 15000 million

(7) 10000 million

Remember

❂ **The universe :**

It is the wide and extended space that contains all the galaxies, stars, planets, moons, living organisms and everything.

❂ The universe contains about 100 000 million galaxies.

❂ **Galaxies :**

• They are groups of stars that rotate together in cosmic space by the effect of gravity.
• They are the greatest units that form the universe.

❂ **Galaxies clusters :**

They are groups of galaxies that rotate together in cosmic space by the effect of gravity.

❂ **The solar system :**

It contains the Sun and eight planets revolving around it.

❂ Our solar system belongs to Milky Way galaxy.

❂ The solar system is located in one of the spiral arms of the Milky Way on the edge of the galaxy.

❂ The Sun takes about 220 million years to complete one rotation around the centre of the galaxy.

❂ **Light year :**

It is the distance covered with light in one year and it equals 9.46×10^{12} km.

❂ **Expansion of the universe :**

It is the continuous separation between galaxies in the space as a result of their regular movement.

❂ **Big Bang :**

It is a theory that explains the origin of the universe from a massive explosion since 15000 million years and resulted in it all forms of matter, energy, time and space followed by continuous expansion and changing processes.

❂ **Nebula :**

It is a glowing gaseous sphere revolving around itself, from which the solar system was originated.

❂ **The force of gravity :**

It is the force that keeps the continuity of the planets rotation in their orbits around the Sun.

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○ Stars explosion phenomenon :

Glowing of a star for a short time to become one of the most shining stars in the sky, then its glowing disappears gradually to return as it was.

○ Theories about the evolution of the solar system :

1. The nebular theory (Laplace) :

It assumed that the origin of the solar system was the "nebula".

1. The solar system originated from a glowing gaseous sphere revolving around itself. This sphere is called "nebula".

2. The nebula lost its heat gradually, so its size contracted and its revolving speed around itself increased.

3. The nebula lost its sphere form and became in a form of a flat rotating disk and some parts separated from it to form gaseous rings.

4. • The gaseous rings cooled down and frozen forming the planets of the solar system.

  • The flaming mass that is remained in the centre formed the "Sun".

2. The crossing star theory (Chamberlain and Moulton) :

It assumed that the solar system was originally the Sun.

1. A huge star approached to the Sun and attracted it leading to a great expansion in the part of the Sun facing this star.

2. The expanded part from the Sun was exploded leading to :

  • The Sun escaped from the gravity of that star.

  • A gaseous line was formed of a great length from the Sun until the last planets.

3. The gaseous line started to condense due to the attraction force, then it cooled forming the planets.

3. The modern theory of the world (Fred Hoyle) :

It assumed that the solar system was originally a star rather than the Sun.

1. A star was rotating around the Sun.

2. The star was exposed to explosion due to huge nuclear reactions.

3. The force of the explosion led to :

  • The bombing of the star's nucleus away from the gravity of the Sun.

  • A gaseous cloud from this star remained around the Sun.

4. The gaseous cloud subjected to cooling and contraction processes forming planets, then the attraction force of the Sun controlled the orbits of planets around it.

Questions
on the lesson

Interactive Exercises

1. Choose the correct answer :

1. The number of galaxies in the universe is about .... million galaxies. *(Qena 2020)*
   a. 10 000   b. 100 000   c. 20 000   d. 200 000

   (Cairo 2017/Luxor 2018)

2. The building units of the universe are ....
   a. planets.   b. stars.   c. galaxies.   d. moons.

   (Port Said 2019)

3. The universe contains ....
   a. galaxies and stars.
   c. living organisms.
   b. planets and moons.
   d. all the pervious answers.

   (Minia 2018)

4. Galaxies are formed of groups of ....
   a. moons.   b. constellations.   c. stars.   d. planets.

   (Ismailia 2018)

5. Galaxies gather in groups known as ....
   a. galaxies clusters.
   c. ancestral galaxies.
   b. solar system.
   d. planets.

6. .... are located in the spiral arms of Milky Way galaxy.
   a. Old stars   b. Moons   c. Small stars   d. (a) and (c)

7. .... is the star of our solar system.
   a. Moon   b. Galaxy   c. The Earth   d. The Sun

8. The Sun and the surrounding planets revolve around the centre of the ....
   a. Earth.   b. Moon.   c. Galaxy.   d. no correct answer.

9. The solar system consists of the Sun and .... planets rotate around the Sun.
   a. nine   b. eight   c. six   d. seven   *(Qena 2020)*

10. The solar system is located in one of the .... arms of the Milky Way galaxy.   *(Behira 2020)*
    a. spiral   b. oval   c. straight   d. circular

11. The Sun takes about .... to complete one rotation around the centre of the galaxy.
    a. 220 thousand years
    c. 230 million years
    b. 220 million years
    d. 320 million years   *(Fayoum 2016, 2018)*

12. The light year is ....   *(Qena 2011)*
    a. the distance covered with light in one year.
    b. the light speed in km/sec.
    c. the time consumed by light to cover a certain distance.
    d. the speed of light and electromagnetic waves in km/sec.

13. Astronomers measure the distances between stars with light year, because the stars ....
    a. generate great amounts of light and heat.
    b. seem small light points.
    c. are millions of kilometres away from each other.
    d. no correct answer.

14. The scientists believe that the universe emerged from a massive explosion and it is in ....
    a. continues contraction.
    b. contraction then expansion.
    c. expansion then contraction.
    d. continues expansion. *(Assiut 2020)*

15. The continuous expansion of the universe is due to .... *(Assiut 2019)*
    a. separation of galaxies.
    b. approaching of galaxies.
    c. equivalent of galaxies.
    d. no correct answer.

16. Scientists believe that the matter of the universe was a .... ball of high pressure and high temperature. *(Behira 2017 / Minia 2019)*
    a. liquid   b. solid   c. gaseous   d. no correct answer

17. After minutes from the Big Bang, the temperature becomes .... million degrees.
    a. 100   b. 1000   c. 10000   d. 100000

18. .... are originated after about 2000 : 3000 million years of the Big Bang.
    a. Galaxies   b. Stars   c. Planets   d. Ancestral galaxies

19. .... began to form after 3000 million years of the Big Bang. *(Sohag 2019)*
    a. Galaxies   b. Stars   c. Planets   d. Ancestral galaxies

20. The two gases which produced galaxies, stars and universe over millions of years are .... *(Cairo, Kalyoubia 2020)*
    a. oxygen and helium.
    b. oxygen and carbon dioxide.
    c. hydrogen and helium.
    d. hydrogen and carbon dioxide.

21. Within minutes after Big Bang, hydrogen gas was formed by a precentage of ....
    a. 25 %   b. 50 %   c. 75 %   d. 100 % *(Minia 2020)*

22. Within minutes after Big Bang, helium gas was formed by a precentage of ....
    a. 75 %   b. 65 %   c. 55 %   d. 25 %

23. According to the Big Bang theory, within minutes from the origin of the universe, the ratio of hydrogen to helium is .... *(Fayoum, Beni Suef 2020)*
    a. 75 : 1   b. 25 : 1   c. 3 : 1   d. 1 : 3

24. The Milky Way galaxy took its disc form after about .... million years from the Big Bang. *(Qena 2019)*
    a. 1000   b. 3000   c. 5000   d. 10000

25. The Sun was born after about .... million years from the Big Bang. *(Luxor 2018)*
    a. 3000   b. 2000   c. 15000   d. 10000

26. The earliest life forms began to appear on the Earth after about .... million years
from the Big Bang. *(Sharkia 2019 / Sohag, Luxor 2020)*
   a. 15000   b. 13000   c. 12000   d. 10000

27. Planets rotate around the Sun by the effect of the gravity of ....
   a. the Sun.   b. Jupiter.   c. the Earth.   d. the moon.

28. The biggest star that can be seen clearly by people on the Earth is .... *(Sharkia 2017)*
   a. Saturn   b. the Sun   c. Uranus   d. Neptune

29. The theory which explains how the universe originated is .... theory. *(Giza 2017)*
   a. crossing star   b. nebular   c. solar nebular   d. Big Bang

30. From the oldest theories which is explained the evolution of the solar system is
the theory of .... *(North Sinai 2015)*
   a. the crossing star.   b. the nebula.   c. the Big Bang.   d. Fred Hoyle.

31. The scientist who established the nebular theory is .... *(Ismailia 2017 / Gharbia 2019)*
   a. Newton.   b. Chamberlain.   c. Laplace.   d. Moulton.

32. According to Laplace assumptions, the nebula gradually lost its heat, so ....
   a. its size contracted only.
   b. its revolving speed around itself increased only.
   c. it is vanished.
   d. (a) & (b) are correct. *(Dakahlia 2018 / Menofia 2020)*

33. Laplace theory assumed that the gaseous rings separate from nebula after its cooling
and freezing forming the ....
   a. Sun.   b. planets of the solar system.
   c. gaseous ball.   d. universe.

34. .... theory assumed that the solar system was originally a glowing gaseous sphere.
   a. Nebular   b. Crossing star   c. Modern   d. No correct answer
   (Kalyoubia 2015)

35. The scientist(s) who established the crossing star theory is/are ....
   a. Chamberlain and Moulton.   b. Laplace.   *(Alex. 2018 / Suez 2020)*
   c. Newton.   d. Fred Hoyle.

36. .... theory assumed that the origin of the solar system was from the explosion of
the expanded part of the Sun forming a gaseous line of a great length from
the Sun due to a huge star approached to it. *(Kalyoubia 2016 / North Sinai 2020)*
   a. Nebular   b. Big Bang   c. Crossing star   d. Modern

37. The founder of modern theory to explain the origin of the solar system is ....
   a. Chamberlain.   b. Moulton.   c. Fred Hoyle.   d. Laplace.
   (Assiut 2019 / Giza 2020)

38. In the modern theory, bombing the star nucleus away was due to ....
   a. the force of gravity.
   b. collision by asteroids.
   c. drop in temperature.
   d. huge nuclear reactions.

39. Fred Hoyle assumed that the Sun controls in the orbits of planets around it due to .... of the Sun.

   (Dakahlia 2019)
   a. the temperature
   b. rotational speed
   c. the attraction force
   d. glowing

40. Astronomers use special equipment to study the Sun, this equipment is the ....
   a. glasses.
   b. telescope.
   c. lens.
   d. no correct answer.

   (Port Said 2018)

41. The Hubble telescope was launched in April in ....   *(Assiut 2018)*
   a. 1905
   b. 1990
   c. 1995
   d. 1959

2. Choose from column (B), what suits those in column (A) :

1.

(A)	(B)
1. The Sun	a. is the space that contains galaxies.
2. The galaxy	b. form galaxies.
3. The solar system	c. is the greatest unit that form the universe.
4. The universe	d. is the measuring unit of the distances between stars.
5. The light year	e. contains the Sun and eight planets revolving around it.
6. The Milky Way	f. is the galaxy that our solar system belongs to.
7. Stars	g. is the star of our solar system.

2.

(A)	(B)
1. The crossing star theory	a. explains that the origin of the solar system is a glowing gaseous rotating sphere.
2. The nebular theory	b. assumes that the origin of the solar system is a star rather than the Sun.
3. The modern theory	c. assumes that the origin of the solar system is the Sun.
	d. thinks that the origin of the solar system is the Earth.

(Fayoum 2015)

3. Put (✓) or (✗) in front of the following sentences and correct the false ones:

1. The Earth is the space that contains all the galaxies, stars, planets, moons and living organisms. ( )
2. 📖 Galaxies move away in the cosmic space. *(Assiut 2015)* ( )
3. 📖 Galaxies rotate in a system around the centre of the universe. ( )
4. 📖 The universe contains various galaxies that move away from each other. ( )

(Giza 2015)

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5. 📖 Each group of stars is gathered in the solar system. *(Suez 2018 / Qena 2019)* ( )
6. 📖 The solar system is located at the edge of Milky Way galaxy. *(Kafr El-Sheikh 2011)* ( )
7. 📖 The solar system contains a lot of stars. *(Qena 2015)* ( )
8. 📖 Eight planets including the Earth rotate around the galaxy. *(North Sinai 2018)* ( )
9. 📖 Nine planets rotate around the Sun. *(Cairo, Suez 2018)* ( )
10. 📖 The universe emerged from the particles of oxygen and nitrogen. *(Qena 2019)* ( )
11. The universe is in a state of continuous expansion. *(Qena 2016)* ( )
12. 📖 Galaxies emerged from the Big Bang. *(Qena 2018)* ( )
13. The matter of the universe was a gaseous ball of high pressure and high temperature. ( )
14. Galaxies began to form after about 2000 million years from the Big Bang. ( )
15. Our galaxy took its disc form after about 5000 million years from the Big Bang. ( )
16. 📖 The crossing star is the largest star that can be seen from the surface of the Earth. *(Beni Suef, Qena 2018)* ( )
17. The gravity of the Earth keeps the rotation of planets in fixed orbits around the Sun. *(Damietta 2015)* ( )
18. An assumption of the crossing star theory is that a star revolves near the Sun. ( ) *(Kalyoubia 2019)*
19. Fred Hoyle who put the nebular theory about the evolution of the solar system. ( ) *(Luxor 2018)*
20. According to modern theory the star exploded due to huge nuclear reactions. ( ) *(Matrouh 2019)*
21. According to Laplace theory, the origin of the solar system was the Sun. ( )
22. Attraction force of the Sun that controls the orbits of planets around it, is one of Laplace's assumptions. *(Kalyoubia 2018)* ( )

4. Correct the underlined words:

1. Each galaxy has a distinctive shape according to the harmony and order of the groups of <u>planets</u> in it. *(Giza 2016, Gharbia 2017)*
2. The solar system lies in <u>Andromeda</u> galaxy. *(Port Said 2018, 2020)*
3. The <u>galaxy</u> is the distance covered with light in one year. *(Sharkia 2015, 2019)*
4. The old stars gather in the <u>edges</u> of the galaxy. *(Ismailia, Beni Suef 2019)*
5. The solar system lies in one of the <u>circular</u> arms of the Milky Way galaxy. *(Minia 2020)*
6. The solar system contains many <u>stars</u>. *(Aswan 2019)*
7. The <u>crossing star</u> is a big star can be seen from the Earth. *(Assiut 2019, Aswan 2020)*

8. The unit for measuring distances between galaxies is <u>kilometre</u>. *(Dakahlia 2016)*

9. The Sun takes about <u>100 million years</u> to complete one rotation around the centre of the galaxy. *(Port Said 2019)*

10. The Sun and the surrounding planets revolve around the centre of the <u>solar system</u>. *(Gharbia 2018)*

11. According to Big Bang theory the universe is formed by merging of <u>oxygen and nitrogen</u> particles. *(Sohag 2019)*

12. Many scientists believe that the universe emerged from a massive explosion called Big Bang since <u>500 thousand years</u>. *(Sharkia 2018)*

13. The theory that explains the origin of the universe is the <u>nebular theory</u>. *(Suez 2020)*

14. The <u>Big Bang</u> theory depends on there is something that looks like clouds or nebula in the space. *(Assiut 2018 / Giza 2020)*

15. The <u>crossing star</u> is a glowing gaseous sphere revolving around itself from which the solar system was originated. *(Dakahlia 2019)*

16. The scientist <u>Isaac Newton</u> published a research entitled "World order". *(Behira 2020)*

17. Nebular theory suggested that the solar system was originated from a glowing gaseous sphere revolving around <u>the Sun</u>. *(Cairo 2018)*

18. The Earth rotates in a fixed orbit due to the effect of the <u>Earth's gravity</u>. *(Menofia 2016)*

19. The Earth planet belongs to a galaxy called <u>Hubble</u>. *(Red Sea 2017)*

20. The founder(s) of crossing star theory <u>is Laplace</u>. *(Aswan 2018)*

21. Sudden violent <u>chemical</u> reactions occur within the star which led to its explosion. *(Sohag, Gharbia 2020)*

22. The scientist who established the modern theory about the origin of the solar system was the scientist <u>Laplace</u>. *(Assiut 2018 / Fayoum, Cairo 2019)*

5. Write the scientific term of each of the following statements :

1. • ☐ The space which contains all the galaxies, stars, planets, moons, living organisms and everything. *(Minia, Gharbia 2020)*

   • It is the wide and extended space that contains galaxies. *(Suez 2018 / Giza 2020)*

2. • The greatest units that form the universe.

   • A large gathering groups of stars found in clusters. *(Ismailia 2014)*

   • Groups of stars that rotate together in the space by the effect of gravity. *(Dakahlia 2020)*

   • Many groups of stars have distinctive shape and harmony. *(Alex. 2019, 2020)*

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3. The group of galaxies which revolves together in the universe space due to the gravity. *(The New Valley 2019)*

4. • 📖 It contains all the stars we see at night in the sky. *(Beni Suef, Assiut 2020)*
   • The galaxy that is our solar system belongs to.
   • A galaxy appears in the sky at night as spreading straw or splashing milk.
   • It contains the Sun and the solar system. *(Sharkia 2019 / Sohag 2020)*

5. • 📖 It is located in one of the spiral arms of the Milky Way galaxy on the edge of the galaxy. *(Assiut 2019 / South Sinai 2020)*
   • It contains the Sun and eight planets revolving around the Sun. *(Sharkia 2020)*

6. • The unit that is used to measure the distances between the celestial bodies. *(Minia 2020)*
   • The distance that is covered with light in one year. *(Minia 2013 / Fayoum 2019)*

7. The continuous separation between galaxies in the universe due to their regular motion. *(Damietta, Port Said 2020)*

8. • 📖 The expansion of the universe and merging of atomic particles forming helium and hydrogen gases. *(Gharbia 2015 / Kafr El-Sheikh 2019)*
   • A theory that explains the origin of the universe due to a great explosion, followed by continuous expansion and changing processes since 15000 million years. *(Assiut 2020)*

9. 📖 The biggest star that can be seen clearly by people on the Earth. *(Red Sea 2017, 2018)*

10. The force that controls in the orbits of planets around the Sun according to modern theory. *(Qena 2020)*

11. The scientist who established the nebular theory. *(Minia 2019)*

12. The scientists who established the crossing star theory about the evolution of the solar system. *(Assiut 2018)*

13. • 📖 A flat gaseous round disk that formed the solar system. *(Fayoum, Qena 2020)*
   • A glowing gaseous sphere revolving around itself that formed the solar system. *(Giza 2015 / Sohag, Ismailia 2019)*

14. A theory assumed that the solar system was originally a glowing gaseous sphere revolving around itself. *(Sharkia 2016)*

15. A theory assumed that the solar system was originally a big star (the Sun). *(Minia 2019)*

16. • A theory assumed that the solar system was originally a star rather than the Sun.
   • A theory assumed that the solar system was originally a star which was glowing for a short time and then its glowing disappears gradually. *(Luxor 2019)*

17. Glowing of a star for a short time to be come one of the most shining stars in the sky, then its glowing disappears gradually to return as it was. *(Giza 2016)*

18. Special equipments centered on the Earth or carried into space used to study the Sun.

(Ismailia 2017)

19. An equipment was launched to the space, allows astronomers an opportunity to study the evolution of the universe after the Big Bang. *(Alex. 2011 / Gharbia 2019)*

6. Complete the following statements :

1. The space which contains all the galaxies, stars, planets, moons and living organisms is called ....

   (Assiut 2019)

2. .... are formed of groups of stars in the universe. *(Sharkia 2018)*

3. Each galaxy has a distinctive shape according to .... and .... of the groups of stars in it.

   (Gharbia 2011, 2015)

4. The stars move in fixed orbits around the centre of the .... *(Qena 2019)*

5. The galaxy that our the Earth planet (or solar system) belongs to is called ....

   (Gharbia 2019)

6. The building unit of the universe is .... and its number in the universe is about ....

   (Damietta 2013 / Fayoum 2020)

7. Galaxies gather in groups called .... including the .... galaxy which including the Sun.

   (Kafr El-Sheikh 2018)

8. In Milky Way galaxy, the old stars gather in the .... of the galaxy, while small stars are located in the .... arms of the galaxy. *(Damietta 2017 / Matrouh 2018)*

9. The solar system contains a number of .... revolve around the Sun. *(Assiut 2019)*

10. The Sun takes about .... million years to complete one rotation around the centre of the galaxy.

    (Kafr El-Sheikh 2019 / Cairo 2020)

11. .... is the unit used for measuring the distances between the celestial bodies.

    (Dakahlia 2015 / Giza 2020)

12. The Sun and the surrounding planets revolve around the centre of .... galaxy.

    (Cairo 2018 / Aswan, Fayoum 2019)

13. The scientists believe that the universe originated from a massive explosion called the ....

14. Scientists believe that the matter of the universe was a .... ball of high .... and high .... and in a small volume.

    (Giza 2018)

15. The planets revolve around the .... in stable orbits. *(Minia 2014)*

16. The solar system is located in one of spiral arms of the .... on the edge of the ....

    (Assiut, Damietta 2020)

17. Within minutes of the Big Bang, the atomic particles merged together producing .... and .... gases.

    (North Sinai, Red Sea 2020)

18. Galaxies began to form after .... million years after the Big Bang. *(Behira 2019)*
19. Milky Way galaxy took its .... form after .... million years of the Big Bang.
20. The two gases which formed the universe's matter are helium and hydrogen with a percentage .... to .... respectively. *(Beni Suef 2018)*
21. The french scientist Pierre Simon Laplace published a research entitled .... *(Port Said 2018)*
22. The planets of the solar system are kept in their orbits due to .... *(Ismailia 2017)*
23. As the distance between the planet and the Sun increases, the Sun's gravitational force .... and its motion around the Sun becomes .... *(Red Sea 2018 / Dakahlia 2020)*
24. Scientist Laplace has been affected by two observations which are the presence of .... in space and the presence of rings surrounding .... planet.
25. The scientist who found the nebular theory about the evolution of the solar system is .... *(Sharkia 2018 / Port Said 2020)*
26. Laplace's theory, over the time, the nebula lost its heat gradually, so its size .... and its revolving speed around .... increased. *(Beni Suef 2014 / New Valley 2019)*
27. The scientists who established the crossing star theory are .... and .... *(Ismailia 2016)*
28. In the crossing star theory, the explosion of the expanded part of the Sun facing the crossing star led to formation of a .... line of a great length and also the .... escaped from the gravity of this star.
29. The scientist who established the modern theory of the world is .... *(Gharbia 2020)*
30. .... theory assumes that the origin of the solar system is the Sun, while .... theory assumes that the origin of the solar system is a star rather than the Sun.
31. The scientist .... established his theory about the origin of the solar system on the base of stars explosion phenomenon. *(Menofia 2018)*
32. According to the modern theory the gaseous cloud subjected to .... and .... processes forming the matter of planets. *(Matrouh 2019 / Minia 2020)*
33. .... telescope is used in studying the Sun from the Earth's surface.
34. The .... telescope is from the space telescopes.

7. Give reasons for the following :

1. Our galaxy is called the Milky Way galaxy. *(Sharkia 2016 / Menofia 2017)*
2. • The difference in the shapes of galaxies that form the universe.
   • Each galaxy in the universe has a distinctive shape. *(Assiut 2018 / Menofia 2019)*
3. • Astronomers don't measure the distances between stars in kilometres.
   • The distances in the universe are measured in light year. *(Menofia 2018)*

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4. ☐ The continuous expansion of the space (universe). *(Matrouh 2019 / Kalyoubia 2020)*

5. ☐ Galaxies move away from each other. *(Gharbia, Red Sea 2018)*

6. The stability of the Earth rotation in an orbit around the Sun. *(Alex., Suez 2017)*

7. The constancy of the planets in their orbits around the Sun. *(Minia, Kafr El-Sheikh 2019)*

8. • The nebula lost its sphere form and became in a form of a flat rotating disk. *(Sohag 2018)*
   • Separation of parts of nebula and formation of gaseous rings rotate in the same direction in which the nebula rotates.

9. Explosion of some stars suddenly. *(Minia 2018 / Red Sea 2020)*

10. The Sun escaped from the gravity of the huge star in the crossing star theory. *(Beni Suef 2019)*

8. What is meant by ... ?

1. The universe. *(Sohag 2018 / Alex. 2020)*

2. Galaxies. *(Ismailia 2016, 2017)*

3. Milky Way galaxy. *(Port Said 2012)*

4. Light year. *(Menofia, Minia 2017)*

5. The expansion of the universe. *(Port Said, Behira 2018)*

6. Big Bang. *(Port Said 2016)*

7. Nebula. *(Qena, Matrouh 2019)*

9. ☐ Write a short paragraph illustrates each of the following :

1. The cosmic space (universe). *(Cairo, Assiut 2016)*

2. The solar system. *(South Sinai 2015)*

3. Galaxy. *(Giza, Gharbia, Suez 2017)*

4. Nebula. *(Suez 2018)*

5. The crossing star theory.

10. What are the results based on ... ?

1. • Galaxies move away from each other as time passes.
   • Separation [distances] of galaxies. *(Red Sea 2016)*

2. Groups of stars are gathered in the universe. *(Sharkia 2015)*

3. The merge of the atomic particles together within minutes of the Big Bang. *(Sharkia, Minia 2018)*

4. Occurrence of Big Bang.

5. The nebula lost its temperature in Laplace's opinion. *(Beni Suef 2020)*

6. The expanded part between the Sun and the crossing star explodes according to Chamberlain and Moulton. *(Beni Suef, Luxor 2018)*

7. The explosion of the star nearer to the Sun according to Fred Hoyle. *(Kalyoubia 2020)*

8. Approaching of a huge star to the Sun according to the crossing star theory. *(South Sinai 2020)*

9. The gaseous cloud is cooled (in Fred Hoyle theory). *(Gharbia 2018 / Red Sea 2019)*

11. Compare between :

1. Universe and galaxy. [concerning : the definition] *(Matrouh 2014)*

2. Solar system and galaxy. [concerning : the definition] *(Port Said 2019)*

3. Nebular theory assumptions and modern theory assumptions. [concering : the origin of the solar system] *(Sohag 2019 / Ismailia 2020)*

4. Nebular theory assumptions and crossing star theory assumptions concerning :
   a. the name of the scientist. *(Port Said, Gharbia 2018)*
   b. the origin of the solar system.

5. Modern theory and crossing star theory concerning : *(Beni Suef 2018 / New Valley 2020)*
   a. the name of the scientist. *(Menofia 2019)*
   b. the origin of the solar. *(Ismailia, Beni 2019)*

12.
• Explain an activity to prove that the universe is in a continuous expansion.

• Show by an activity the concept of expansion of the universe. *(Minia 2016)*

13. What happens ... ?

1. • If the gravity between the Sun and planets which rotate around is vanished. *(Cairo, Port Said 2017)*

   • When there is no gravity in the solar system. *(Sharkia 2017)*

   • When the force of the Sun gravity doesn't control the orbits of planets around it. *(Port Said 2015)*

2. When the distance between a planet and the Sun increases. *(Luxor 2017 / Matrouh 2019)*

3. If the organization and arrangements of the groups of stars in galaxy were changed. *(Kalyoubia 2019)*

14. Mention the importance of each of the following:

1. Gravity in solar system. *(Matrouh 2019 / Alex 2020)*

2. Light year. *(Matrouh 2019)*

3. The gaseous line in the crossing star theory. *(Sharkia 2015 / Matrouh 2019)*

4. Solar telescope. *(Minia 2018 / Ismailia 2019)*

5. Hubble telescope. *(Menofia, Gharbia 2017 / Ismailia 2018)*

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15. Mention the contributions of the following scientists to science :

1. Simon Laplace.

2. Chamberlain and Moulton.

3. Fred Hoyle.

16. Variant questions :

1. **After minutes from the Big Bang, clouds of two gases were formed which produced galaxies, stars and universe over millions of years.**

   (a) What is the name of the two gases ? What is the percentage of each of them ?

   (b) How much was the temperature during these minutes ?

2. **The research published by the french scientist Laplace in 1796 gained a great reputation for a century.**

   (a) What is the title of this research ?

   (b) Mention two observations affect the perception of Laplace about the evolution of the solar system. *(Dakahlia 2019)*

   (c) Mention the stages of Laplace theory to explain the origin of the solar system.

3. **Write the assumptions of the crossing star theory for the origin of the solar system.**

   (Kalyoubia 2018 / New Valley 2019)

4. **Fred Hoyle depended on the scientific facts to his assumptions about the origin of the solar system. Discuss the statement and explain.**

   (a) This fact.

   (b) The hypothesis of Fred Hoyle theory.

5. **Give the number which indicates each of the following :**   *(Behira 2018)*

   (a) The age of the universe according to the Big Bang.

   (b) The number of galaxies in the universe.

17. According to the Big Bang theory, re-arrange the following events from the oldest to the latest :   *(Beni Suef 2016)*

- The Sun was born and the Earth and the planets were created.

- Ancestral galaxies were originated.

- Earliest life forms began to appear on the Earth.

- Matter got joined in masses.

18. Study the following figures, then answer:

1. Study the opposite figure, then answer :

(a) What's the galaxy which our solar system belongs to ?

(b) What does points (X), (Y) and (Z) refer to ?

(c) Where do the old and recent stars lie in the galaxy ?

(d) What is the time required by the symbol (Z) to make one complete rotation around the symbol (X) ?

2. The opposite figure represents an activity to one of the processes that takes place for the universe :

(a) What does each of the following represent ?

1. The swelling of dough ?

2. The separation of the grains of raisins ?

(b) What do you conclude from the presence of the distances between the grains of raisins after a period from fermentation of dough ?
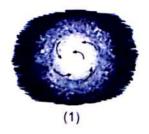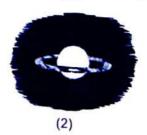
3. The opposite figure represents an imaginary figure for an event that explains the origin of the universe :
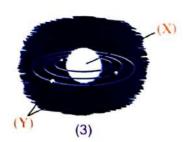
(a) What is the event represented by this figure ?

(b) What does the scientists believe about the matter of the universe before this event ?

(c) What is the time period between this event and the birth of the Sun ?

4. The following figures represent the stages of Laplace theory to explain the origin of the solar system. Answer the following questions:

(1)   (2)   (Y)   (3)   (X)
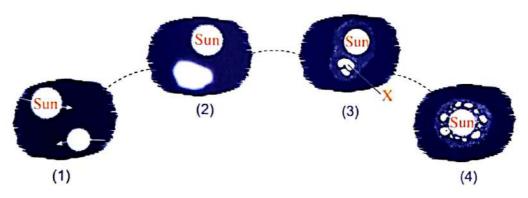
(a) What is the name of this theory ?

(b) What does the figure (1) represent ? What is its origin ?

(c) What led to the formation of what is shown in figure (2) ?

(d) What does the stage in figure (3) represent?

(e) From which (X) and (Y) are formed ?

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5. The opposite figure illustrates one of the theories that explains the origin of the solar system for the scientists Chamberlain and Moulton.

Answer the following questions :

(a) What is the name of this theory ?

(b) Lable the figure.

(c) What is the number that points to the origin of the solar system according to this theory ?

(d) What is the result of the explosion occurred as shown in number (2) ?

(e) How did the planets of the solar system were formed according to this theory ?

(1) —

(2) —

(3) —

6. The following figure illustrates the assumptions of the modern theory for the scientist Fred Hoyle that explains the origin of the solar system.

Answer the following questions :

(1)   (2)   (3)   (4)

Sun   Sun   Sun   Sun

X

(a) Label the figure.

(b) What does symbol (X) point to ? And what happened to it according to this theory ?

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Timss Questions

1. Arrange each of the following :

1. Milky Way galaxy / The Earth / Universe / Solar system.

[ascendingly according to the size]

2. Birth of the Sun / Galaxies began to form / Big Bang / Earliest life forms began to appear / Formation of hydrogen and helium gases.

[ascendingly according to the sequence of its occurrence]

2. Give a reason for :

It is impossible to collide two planets together.

Project

On UNIT THREE

A project to develop the analytical thinking
"Detection of basic items"

• Detect three words, names or concepts related to each of the following :

1. Solar system.

2. Universe.

3. Milky Way galaxy.

4. Nebular theory.

5. Modern theory that explains the evolution of the solar system.

6. Crossing star theory.

7. Solar telescope.

8. Earliest life forms on the Earth.

9. Shapes of galaxies.

10. Big Bang theory.

Reproduction and Species Continuity
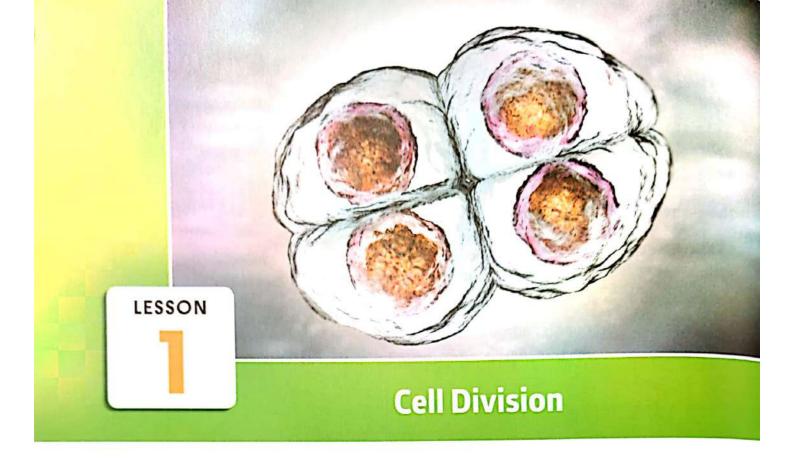
1. Cell Division.

2. Sexual and Asexual Reproduction.

▶ Unit Objectives :

By the end of this unit, students will be able to :
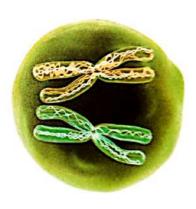
- Identify chromosomes and their role in cell division.

- Trace phases of mitosis and illustrate its importance.

- Trace phases of meiosis and illustrate its importance.

- Compare between mitosis and meiosis.

- Identify the concept of asexual reproduction.

- Identify that asexual reproduction produces offspring identical to parents.

- Identify the concept of sexual reproduction.

- Conclude that sexual reproduction is a source of genetic change.

Cell Division

What are the types of cells in multicellular living organisms ?

Not all cells of multicellular organisms are similar, but they have some differences, from which how they divide to increase their number.

The cells of multicellular living organisms are two types which are

Somatic cells

All body cells (except reproductive cells), Such as :

The cells of (liver, skin, kidney, ...) in humans and animals.

The cells of (roots, stem, leaves, ...) in plants.

Reproductive cells

Such as :

Testes and ovaries cells in humans and animals.
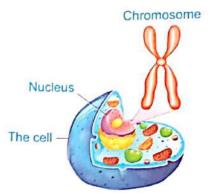
Anthers and ovaries cells in flowering plants.

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Chromosomes

Chromosome

All types of cells contain nucleus, which contains thread like bodies called chromosomes, that have the main role in cell division.

Nucleus

Chromosomes

They are thread like bodies present in cells' nuclei and they represent the genetic material of the living organism.

The cell

Structure of chromosomes :

General structure of chromosomes :

The chromosome consists of :

- Two connected threads, each thread is called "Chromatid".
- The two chromatids are connected at a point known as "Centromere".

Centromere

It is the point of connection of the two chromatids of chromosome.
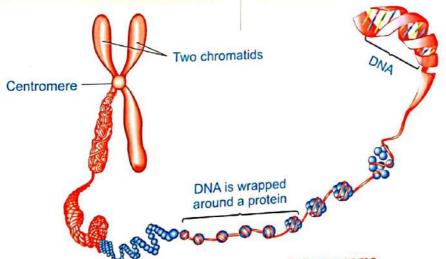
Chemical structure of chromosomes :

Each chromatid consists of :

(a) A nucleic acid called "DNA" which carries the genes that carry the genetic traits of the living organism.

(b) Protein.
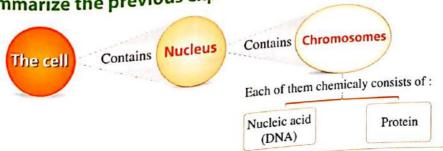
DNA

It is the nucleic acid that carries the genetic traits of the living organism.

Two chromatids

Centromere

DNA

DNA is wrapped around a protein

The chemical structure of chromosome

*We can summarize the previous explanation in the following diagram :

The cell ·· Contains Nucleus ·· Contains Chromosomes

Each of them chemicaly consists of :

| Nucleic acid (DNA) | Protein |

Number of chromosomes :

1. The number of chromosomes in living organisms **differs** from one species to another.

2. The number of chromosomes is **fixed** in the members of the same species.

For illustration

Organism	Human	Rabbit	Mosquito	Maize	Onion
No. of chromosomes	46	44	6	20	16

3. The number of chromosomes in somatic cells and reproductive cells **differs** from the number of chromosomes in gametes for the same organism as follows :

A

Somatic cells and reproductive cells

- Each one of them contains **a complete number of chromosomes** (complete two sets of chromosomes, one from male gamete and the other from female gamete).
- The number of chromosomes is a **diploid number (2N)**.

B

Gametes [male gametes (sperms) and female gametes (ova)]

- Each one of them contains **a half number of chromosomes** present in reproductive cell or in somatic cell.

- The number of chromosomes is a **haploid number (N)**.

Importance of chromosomes :

1. They represent the genetic material of the living organism.

2. They have the main role in cell division.

3. Knowing the number of chromosomes helps in identifying the animal and plant species.

Exercise

• **Answer the following :**

If the number of chromosomes in a human pancreatic cell equals 46 chromosomes (23 pairs of chromosomes),

How many chromosomes in his following cells :

(1) Liver cell.   (2) Reproductive cell.   (3) Sperm.

Answer

1. 46 chromosomes.   2. 46 chromosomes.   3. 23 chromosomes.

Cell division

The cell division allows the living cell divides into two cells or more, to aim the growth or reproduction.

Types of cell division

There are two types of cell division

First
Mitotic cell division (Mitosis) or indirect cell division

Second
Meiotic cell division (Meiosis) or reduction division
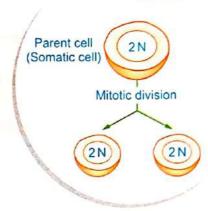
FIRST / Mitotic cell division (Mitosis)

Mitotic cell division (Mitosis) :

It is a kind of cell division that occurs in the somatic cells, at which the cell divides into two new cells (somatic cells), each of them contains the same number (diploid number) of chromosomes of the parent somatic cell.

Parent cell (Somatic cell) 2N

Mitotic division

2N   2N

Site of occurrence : It occurs in somatic cells only such as :

- Cells of pancreas, skin, liver and kidney (in humans and animals).
- Cells of roots, stems, leaves and seeds (in plants).

Note

Some cells in the human body are not divided at all, such as neural cells (as they don't contain centrosome, which plays a role in cell division), and adult red blood cells (as they don't contain nucleus).

Importance of mitosis : It plays an important role in :

1. Compensation of the damaged cells.
2. Completing the asexual reproduction process (we will study it in the second lesson).
3. Growth of living organisms (the growth of seed by mitosis to complete plant).

The growth of seed by mitosis to complete plant

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Phases of mitosis :
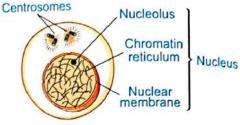
⁕ Before starting mitosis, the cell passes through a phase called interphase.

Interphase

Interphase has an important role before starting

mitosis. GR.

As interphase prepares the cell for division by :

1. Occurrence of some important biological processes.

2. Duplicating the amount of the genetic material (DNA).

Interphase

For illustration only

Duplicating the genetic material, doesn't mean increasing its number, but it means copying it several copies before the cell division, and so each new resulted cell obtains its complete copy of genetic material of the parent cell.

⁕ **From the previous explanation, we can define the interphase as follows :**

Interphase :

It is the phase which is occured before starting the cell division process, at which the cell prepares for division by the occurrence of some important biological processes and the duplicating the amount of the genetic material (DNA).

✎..Note
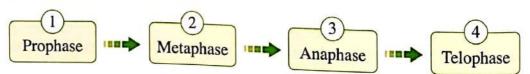
Chromosome which consists of 2 chromatids, do not appear before cell division.

Before cell division, chromosome appears as one chromatid.

During prophase, chromosome appears in the form of 2 chromatids connected with centromere.

⁕ **Phases of mitosis division are :**

1 Prophase ➡ 2 Metaphase ➡ 3 Anaphase ➡ 4 Telophase

Phases (stages) of mitosis :

① Prophase

In this phase :

- Chromatin reticulum condenses (intensifies), then appears in the form of long, thin and double strings chromosomes [as in fig. (a)].

At the end of this phase :

- Nucleolus and nuclear membrane disappear.
- A network of filamentous fibers called "spindle fibers" is formed extending between the two poles of the cell. [as in fig. (b)].
- Each chromosome is connected with one of the spindle fibers by the centromere.

Nuclear membrane
Nucleolus

Fig. (a)

Spindle fibers

Fig. (b)

Prophase

② Metaphase

In this phase :

The chromosomes which are connected with the spindle fibers are arranged at the cell equator.

Metaphase

③ Anaphase

In this phase :
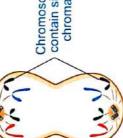
- The centromere of each chromosome splits lengthwise into two halves, so the chromatids separate from each other.
- The spindle fibers begin to shrink and two identical groups of chromosomes (each contains single chromatid) are formed.
- Each group of chromosomes migrates towards one of the cell's poles.

Chromosomes contain single chromatid

Anaphase
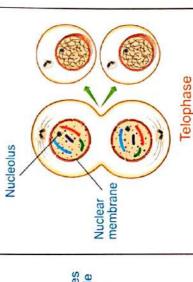
④ Telophase

In this phase :

- The spindle fibers disappear.
- A nuclear membrane is formed around the chromosomes at each of the cell's poles leading to the formation of two new nuclei.
- A nucleolus is formed at each pole of the cell.
- The chromosomes inside each nucleus convert into a chromatin reticulum again.

At the end of this phase :

the cell divides into two new cells, the nucleus of each of them contains complete number of chromosomes (2N) of the parent cell.

Nucleolus

Nuclear membrane

Telophase
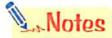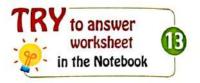
GR. | *The changes which occur in telophase are called the adverse changes.*

Because the changes that occur in telophase are adverse to that occur in prophase.

Notes
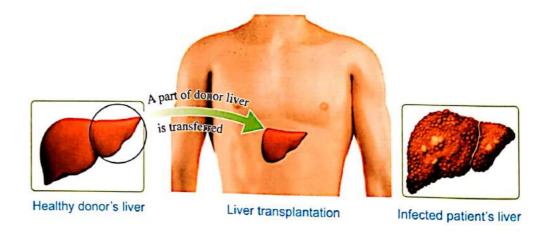
- In **animal cell**, the spindle fibers are formed by the **centrosome**.
- In **plant cell**, the spindle fibers are formed from **condensing the cytoplasm at two poles** of the cell.

TRY to answer worksheet **13** in the Notebook

Science, Technology and Society

Liver Transplantation :

- Some somatic cells such as liver cells are not divided in normal conditions but they retain the ability to divide under certain circumstances.

- *For example,* if the liver gets injured or a part of it is cut, the remaining cells undergo many mitotic divisions to compensate the missing part. This is the scientific basis used in liver transplantation.

- Liver transplantation process is performed to replace the infected patient's liver with a part of a healthy donor's liver, as time passes, the liver of each of them is completed due to the occurrence of mitosis divisions.

A part of donor liver is transferred

Healthy donor's liver   Liver transplantation   Infected patient's liver
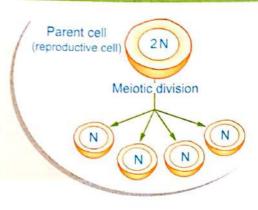
SECOND — Meiotic cell division (Meiosis)

Meiotic cell division (Meiosis) :

It is a kind of cell division that occurs in the reproductive cells, at which the cell divides into four new cells (gametes), each cell contains half the number (haploid number) of chromosomes of the parent reproductive cells.

Parent cell
(reproductive cell) 2 N

Meiotic division

N N N N

Site of occurrence : It occurs only in reproductive cells :

• In humans and animals : It occurs in the testes *[to produce male gametes (sperms)]* and in the ovaries *[to produce female gametes (ova)].*

• In flowering plants : It occurs in the anther *[to produce male gametes (pollen grains)]* and in the ovary *[to produce female gametes (eggs or ova)].*

Importance of meiosis :

- Production of male gametes and female gametes to complete the sexual reproduction.

Phases of meiosis :
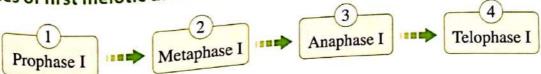
✳ Before starting meiosis, the cell passes through interphase.

- Meiotic division takes place in two stages :

1. First meiotic division.   **2.** Second meiotic division.

1 First meiotic division :

It produces two cells, each of them contains half the number of chromosomes.

✳ Phases of first meiotic division are :

1 Prophase I ▪▪▶ 2 Metaphase I ▪▪▶ 3 Anaphase I ▪▪▶ 4 Telophase I

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Phases of first meiotic division :

1 Prophase I

In this phase :

- Chromatin reticulum condenses, then appears in the form of long, thin and double strings chromosomes.

- Chromosomes are arranged in homologous pairs, each pair consists of 4 chromatids which are called a tetrad.

Tetrad :
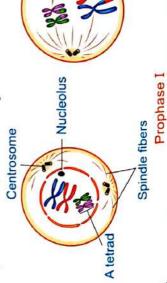
They are the arrangement of homologous pairs of chromosomes, where each pair consists of 4 chromatids.

At the end of this phase :

- Crossing over phenomenon occurs [will be explained in the next page].

- Nucleolus and nuclear membrane disappear.

- The spindle fibers appear and connect to the chromosomes at centromere.

- Each two homologous chromosomes (in the tetrad) move away from each other.

Centrosome

Nucleolus

Spindle fibers

A tetrad

Prophase I

2 Metaphase I

In this phase :

The chromosomes pairs which are connected with the spindle fibers are arranged at the cell equator.

Metaphase I
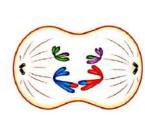
3 Anaphase I

In this phase :

- The spindle fibers begin to shrink, so every two homologous chromosomes move away from each other.

- One of the two chromosomes migrates towards the cell pole and the other migrates towards the other pole.

- Therefore, each pole contains half the number of chromosomes of the parent cell.

Anaphase I
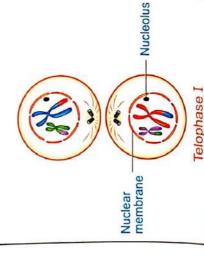
4 Telophase I

In this phase :

- The spindle fibers disappear.

- A nuclear membrane is formed around the chromosomes at each of the cell's poles leading to the formation of two new nuclei.

- A nucleolus is formed at each pole of the cell.

At the end of this phase :

The cell divides into two new cells, the nucleus of each of them contains half number of chromosomes (N) of the parent cell.

Nuclear membrane

Nucleolus

Telophase I

The crossing over phenomenon
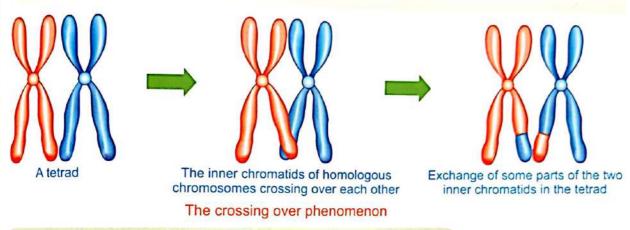
- **Why are the traits different between members of the same species ?**

This is due to the crossing over phenomenon.

Crossing over phenomenon

It is a phenomenon that takes place at the end of prophase I in which some parts of the two inner chromatids of each tetrad are exchanged to produce new genetic arrangements.

| A tetrad | The inner chromatids of homologous chromosomes crossing over each other | Exchange of some parts of the two inner chromatids in the tetrad |

The crossing over phenomenon

Importance of the crossing over phenomenon :
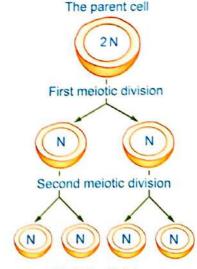
- It works on the variation of genetic traits among the members of the same species, where it contributes in the exchange of genes (that carry genetic traits) between the two homologous chromosome's chromatids and distributing them randomly in the gametes.

2 Second meiotic division :

- **The second meiotic division** aims to increase the number of the produced cells from the first meiotic division, where each cell of the two new cells resulted from the first meiotic cell division is divided again in a way similar to mitotic cell division.

- In the final phase (telophase II) of this division four cells (four gametes) are produced and each of them contains half the number (haploid number) of chromosomes of the parent reproductive cell.

GR. *Meiotic cell division is called by reduction division.*

Because the produced cells contain half the number (haploid number) of chromosomes of the parent reproductive cell.

The parent cell

2 N

First meiotic division

N   N

Second meiotic division

N   N   N   N

Meiotic division

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Phases of second meiotic division are :

① Prophase II	② Metaphase II	③ Anaphase II	④ Telophase II

Notes
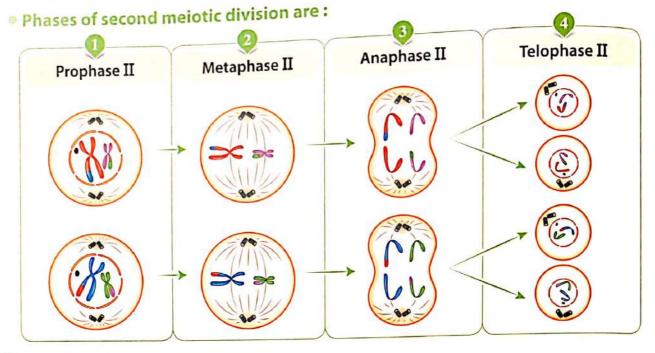
In the first meiotic division	In the second meiotic division
1. Before starting prophase I, the parent reproductive cell passes through interphase, where genetic material is duplicating.	1. Before starting prophase II, the resulted cell from first meiosis doesn't pass through interphase, so the genetic material is not duplicating.
2. Through anaphase I, the centromeres don't split.	2. Through anaphase II, the centromeres split lengthwise.
3. The resulted cells contain a haploid number of chromosomes (N).	3. The resulted cells (gametes) contain a haploid number of chromosomes (N).

① Comparison between reproductive cell and gamete :

Points of comparison	Reproductive cell	Gamete
No. of chromosomes :	Diploid number (2 N)	Haploid number (N)
Kind of division :	Meiotic cell division (Meiosis)	Gamete isn't divided.
Importance :	The production of gametes.	The occurrence of the sexual reproduction process.
Examples Or The location :	- Testes and ovaries cells in humans and animals. - Anthers and ovaries cells in plants.	- Sperm and ovum in humans and animals. - Pollen grain and ovum in plants.

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2 Comparison between mitotic cell division (mitosis) and meiotic cell division (meiosis) :

Points of comparison	Mitosis	Meiosis
Site of occurrence :	It occurs in somatic cells except neural cells and red blood cells.	It occurs in reproductive cells.
Importance :	- Growth of living organisms. - Compensation of damaged cells. - Completing the asexual reproduction process.	Formation of gametes. In males ⟶ sperms or pollen grains. In females ⟶ ova or ovules.
Resulting cells :	Two somatic cells, each cell contains the same number of chromosomes (2N) of the parent somatic cell.	Four gamete cells, each gamete contains haploid number of chromosomes (N) of the parent reproductive cell.
Stages of division :	One stage including four phases which are : [Prophase - Metaphase - Anaphase - Telophase].	Two stages : - First meiotic division. - Second meiotic division. [Each stage includes four phases].

3 Comparison between somatic cell and reproductive cell :

Points of comparison	Somatic cell	Reproductive cell
No. of chromosomes :	Diploid number (2N)	Diploid number (2N)
Kind of division :	Mitotic cell division (Mitosis) [Neural cells and red blood cells are not divided].	Meiotic cell division (Meiosis)
No. of resulting cells :	- Two somatic cells are resulted from the division of a somatic cell. - Each resulted cell contains the same number of chromosomes of the parent somatic cell.	- Four gamete cells are resulted from the division of a reproductive cell. - Each resulted gamete contains haploid number of chromosomes of the parent reproductive cell.
Examples : Or The location :	All body cells [except reproductive cells] like : - (Liver, skin, kidney, ...) in humans and animals - (Roots, stem, leaves, ...) in plants.	- Testes and ovaries cells in humans and animals. - Anthers and ovaries cells in plants.

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Science, Technology and Society

Nano-technology and cancer treatment :

- Cancer occurs when some of the body cells are divided continuously in abnormal way without controlling leading to form a mass of cells which is called the tumor.

Tumor

The mass of cells produced due to the abnormal continuous division of cells.

Abnormal cell

Many successive cell divisions

Tumor

Formation of cancer

- The Egyptian scientist Dr. Mustafa El Said discovered a way to detect the cancer cells and kill them by using very small molecules of gold measured by nanometer unit, so they called Nano-molecules and this technic is called Nano-technology that we can benefit from it in :

Dr. Mustafa El Said

1 Discovering cancer disease :

Discovering the cells infected with cancer by using Nano-technical as follows :

- This technic starts by loading proteins (that have the ability to attach on the cancerous cell secretions) with Nano-molecules of gold and then injecting them into the patient.

- The loaded proteins with Nano-molecules of gold pass from the blood of the patient, then attach on the cancerous cell surface to monitor it through a microscope, each cell separately.
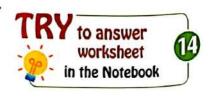
2 Treatment of cancer :

1. By using loaded protein with Nano-molecules of gold as follows :

Focusing laser to a certain degree to the Nano-molecules of gold (present on the cancer cells), then the Nano-molecules of gold absorb the light energy and convert it into heat energy which burns and kills the infected cancer cells , where the healthy cells not affected.

2. By using smart microscopic bombs :

- Using Nano-technology, scientists have developed smart microscopic bombs that penetrate the cancer cells and explode them from inside.

- They were used to kill the cancer cells in experimental mice. Mice suffered from cancer were able to live 300 days after this treatment. As for mice that did not receive treatment, they did not live more than 43 days.

TRY to answer worksheet 14 in the Notebook

Remember

- Nucleus of the cell is responsible for the cell division as it contains chromosomes which represent the genetic material.

Chromosomes :

They are thread like bodies present in cells' nuclei and they represent the genetic material of the living organism.

- Each chromosome consists of 2 chromatids connected by a centromere.

- Each chromosome chemically consists of a nucleic acid (DNA) and protein.

- Number of chromosomes in somatic cells and in reproductive cells is a diploid number (2N).

- Number of chromosomes in gametes is a haploid number (N).

Cell division :

It is a complicated process, through which the living cell divides into two cells or more to aim the growth or reproduction.

There are two types of divisions :

1. Mitotic cell division (mitosis) :

- It occurs in somatic cells such as all body cells except reproductive and neural cells (in case of animal and human) or cells of root, stems and leaves (in case of plant).

- It aims at the growth of organisms, compensation of damaged cells and completing the asexual reproduction.

- It produces 2 cells, each cell contains a diploid number of chromosomes (2N).

2. Meiotic cell division (meiosis) :

- It occurs in reproductive cells such as cells of testes and ovaries (in case of animal and human) or anthers and ovaries (in case of plant).

- It aims to produce gametes.

- It produces 4 cells, each cell contains a haploid number of chromosomes (N).

Crossing over phenomenon :

It is a phenomenon that takes place at the end of prophase I and in which some parts of the two inner chromatids of each tetrad are exchanged to produce new genetic arrangements.

Questions
on lesson one

Interactive Exercises

1. Choose the correct answer :

1. The chemical structure of the chromosome is .... *(Dakahlia 2019)*
   a. the nucleic acid only.
   b. protein and nucleic acid.
   c. protein, fats and nucleic acid.
   d. All the previous.

2. Chromosome is chemically consists of nucleic acid .... and protein. *(Giza 2020)*
   a. HNO_3
   b. H_2SO_4
   c. DNA.
   d. HCL.

3. The somatic cells in most of living organisms contain two groups of chromosomes called ....
   a. diploid number.
   b. haploid number.
   c. spindle fibers.
   d. tetrad.

4. The gametes contain a group of chromosomes called .... *(Luxor 2017)*
   a. diploid number.
   b. haploid number.
   c. spindle fibers.
   d. tetrad.

5. The type of division in somatic cells is .... division.
   a. meiotic
   b. reduction
   c. mitotic
   d. no correct answer

6. Mitotic division happens in cells of the .... *(Suez 2018 / Port Said 2020)*
   a. two testes.
   b. two ovaries.
   c. liver.
   d. (a) and (b) together.

7. .... cells are not divided at all. *(Behira 2018 / Menofia 2019)*
   a. Skin
   b. Adult red blood
   c. Liver
   d. Stomach

8. The .... is the phase in which the cell is prepared for division by doubling the genetic material. *(Kalyoubia 2019)*
   a. prophase
   b. interphase
   c. metaphase
   d. telophase

9. Which of the following is not considered from phases of cellular division ? ....
   a. Prophase.
   b. Interphase.
   c. Metaphase.
   d. Anaphase.

10. The genetic material (chromatin reticulum) condenses and appears in the form of long, thin and double strings in .... *(Dakahalia 2018)*
    a. prophase.
    b. metaphase.
    c. anaphase.
    d. telophase.

11. In the mitotic division, the chromosomes are arranged at the equator of the cell during .... *(Cairo, Alex. 2017)*
    a. metaphase.
    b. prophase.
    c. anaphase.
    d. telophase.

12. Chromosomes are arranged in homologous pairs to form tetrad in .... *(South Sinai 2017)*
    a. metaphase I.
    b. telophase I.
    c. anaphase I.
    d. prophase I.

13. The centromere of each chromosome is divided longitudinally, then the two chromatids are separated from each other and the spindle fibers contract in mitosis during ....
    a. prophase.
    b. telophase.
    c. anaphase.
    d. metaphase.

    (Alex., North Sinai, Sharkia 2018)

14. Spindle fibers appear during the cell division in the .... *(South Sinai, Fayoum 2019)*
    a. prophase.
    b. metaphase.
    c. anaphase.
    d. telophase.

15. Spindle fibers in the animal cell are formed from the .... *(Ismailia 2018)*
    a. centrosome.   b. cytoplasm.   c. nucleus.   d. chromosomes.

16. Spindle fibers disappear during cell division in the .... *(South Sinai 2020)*
    a. prophase.   b. metaphase.   c. anaphase.   d. telophase.

17. The nucleolus disappears during the mitosis cell division in .... *(Dakahilia 2020)*
    a. prophase.   b. metaphase.   c. anaphase.   d. telophase.

18. The right arrangement of the phases of mitosis is ....
    a. prophase, metaphase, anaphase and telophase.
    b. prophase, anaphase, metaphase and telophase.
    c. anaphase, prophase, metaphase and telophase.
    d. metaphase, prophase, anaphase and telophase.

19. Meiotic division happens in the cells of the .... *(Sohag 2018 / Qena 2020)*
    a. liver.   b. testes.   c. skin.   d. bones.

20. The ratio between the number of chromosomes present in the gametes produced by meiotic cell division to the number of chromosomes present in somatic cells is ....
    a. quarter.   b. double.   c. third.   d. half.
    (Sohag, South Sinai 2015)

21. Meiosis is different from mitosis in that each produced cell contains .... of the parent cell. *(Fayoum 2014)*
    a. half the number of chromosomes   b. twice the number of chromosomes
    c. three times the number of chromosomes   d. four times the number of chromosomes

22. Meiotic cell division is responsible for the ....
    a. growth of organisms.   b. compensation of damaged cells.
    c. production of gametes.   d. duplication of cells number.

23. Meiotic division occurs in flowering plants in the anther to produce .... *(Ismailia 2017)*
    a. ovum.   b. pollen grains.   c. sperms.   d. chromosomes.

24. Chromatin reticulum intensifies and appears in form of distinct chromosomes in phase *(Assiut 2018)*
    .... from meiosis division.
    a. prophase I   b. metaphase I   c. anaphase I   d. telophase I

25. Crossing over phenomenon happens in the end of the .... *(Cairo, Gharbia 2020)*
    a. first prophase.   b. first anaphase.
    c. second metaphase.   d. second anaphase.

26. A tetrad consists of .... chromosomes.
    a. 2   b. 4   c. 6   d. 8

27. The first meiotic division differs from the second meiotic division in ....
    a. formation of the spindle fibers.
    b. formation of the tetrad.
    c. formation of the nuclear membrane.
    d. no correct answer.

28. Which of the following represents meiotic division? ....

a. $2N \underset{N}{\overset{N}{<}}$ b. $N + N \longrightarrow 2N$ c. $2N \underset{2N}{\overset{2N}{<}}$ d. $2N \underset{N<\overset{N}{N}}{\overset{N<\overset{N}{N}}{<}}$

29. If the chromosomal number in the somatic cell is 2N, then its number in the reproductive cell is .... *(Beni Suef 2020)*

a. $\frac{1}{2} N$ b. 4N   c. 2N   d. N

30. Number of chromosomes in female gamete equals .... the number of chromosomes in the original cell. *(South Sinai, New Valley 2019)*

a. quarter   b. half   c. the same   d. double

31. The number of the chromosomes in the human liver cell is 23 pairs, which of the following contains a haploid number ? .... *(Damietta 2014)*

a. Skin cell.   b. Pancreatic cell.   c. Fertilized ovum.   d. Sperm.

32. If the nucleus of a maize pollen grains contains 10 chromosomes, then the nucleus of somatic cell of the same plant contains .... chromosomes. *(Behira 2017)*

a. 5   b. 10   c. 15   d. 20

33. The number of chromosomes in pollen grain is .... the number of chromosomes in female ovum. *(Matrouh 2018)*

a. double   b. half   c. equal to   d. quarter

34. If the number of chromosomes in liver cells of a certain living organism is 32 chromosomes, then the number of chromosomes in a reproductive cell is .... chromosomes. *(Minia 2016)*

a. 16   b. 64   c. 23   d. 16 pairs

35. If the cell of muscles in a female rabbit contains 22 pairs of chromosomes, so the number of chromosomes in one cell of its ovary equal .... *(Behira 2019)*

a. 11   b. 22   c. 44   d. 88

36. If the chromosomal number in the male gamete of an organism is 20 so, the chromosomal number in the liver cell equals .... chromosomes. *(Alex. 2018)*

a. 5   b. 10   c. 20   d. 40

37. The number of chromosome in each somatic cell and the sperm of a living organism is respectively .... chromosomes. *(Aswan 2020)*

a. 6,12   b. 5,6   c. 8,8   d. 12,6

38. The variation of genetic traits resulted from meiosis is due to the ....
a. reduction of chromosomal number.   b. crossing over phenomenon.
c. duplication of DNA.   d. formation of tetrads.

39. The cancerous cells can be detected by using of technological Nano-molecules of .... metal. *(Damietta 2015)*

a. zinc   b. iron   c. nickel   d. gold

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2. Choose from column (B), what suits it in column (A) :

1.

(A)	(B)
1. The spindle fibers shrink and two identical groups of chromosomes are formed at each pole of the cell in	a. telophase.
2. Duplication of genetic material occurs in	b. prophase.
3. The nucleolus and nuclear membrane disappear in	c. interphase.
4. The chromosomes are arranged along the cell equator in	d. metaphase.
	e. anaphase.

2.

(A)	(B)
1. Telophase	a. occurs in reproductive cells.
2. Mitotic cell division	b. in which the chromosomes pairs arrange at the equator of the cell.
3. Meiotic cell division	c. occurs in somatic cells.
4. Metaphase (I)	d. the nuclear membrane appears in it.

3.

(A)	(B)
1. Reproductive cells	a. in which mitotic division occurs.
2. Plant cells	b. produce gametes.
3. Somatic cells	c. in which the spindle fibers is formed from the cytoplasm.
	d. contains a haploid number of chromosmes.

(Ismaillia 2019)

3. Put (✓) or (✗) in front of the following statements and correct the false ones :

1. The chromosomes are found inside the cytoplasm of the cell. (   )
2. Chromosomes are rounded bodies. (   )
3. The chromosome consists of two chromatids connected at the cytoplasm. *(Cairo 2018)* (   )
4. The genetic material in the nucleus consists of a number of chromosomes. (   )
5. The chromosome chemically composed of RNA and protein. *(Menofia 2018)* (   )
6. The number of chromosomes in somatic cells is haploid. (   )
7. The number of chromosomes in plant stem equal quarter its number in the pollen grains for the same plant. *(Red Sea 2019)* (   )
8. The gametes contain the diploid number of chromosomes. *(Damietta 2015)* (   )
9. Gamete is the point of connection of the two chromatids of chromosome. (   )
   (Kalyoubia 2015)
10. 📖 Somatic cells are divided by meiosis which leads to the growth of living organisms and compensation of the damaged cells. *(Beni Suef 2016 / Matrouh 2019)* (   )

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11. The genetic material in the cell duplicates in interphase. *(Qena 2018)* ( )

12. The cell is prepared to enter the phases of mitosis division in the anaphase. ( )
(Ismailia 2018)

13. 📖 Chromatin reticulum condenses and appears in the form of long, thin and double strings (chromosomes) in the telophase of the mitotic division. ( )

14. The spindle fibers are formed in the plant cell from the centrosome. *(Matrouh 2019)* ( )

15. The nucleolus disappears during the mitotic cell division in telophase. ( )
(Assiut, Luxor 2016 / Aswan 2018)

16. In the mitotic division, the spindle fibers are formed during the interphase and disappear in the anaphase. ( )

17. In the animal cell, the spindle fibers are formed from condensing the cytoplasm at the cell poles. *(Luxor 2018)* ( )

18. In anaphase, chromosomes arranged at the middle of the cell. *(Red Sea 2018)* ( )

19. Chromosomes are arranged along the cell equator where each chromosome is attached with one of the spindle fibers at its centromere in anaphase. *(New Valley 2018)* ( )

20. The centromere of each chromosome divides longitudinally and the two chromatids separate in telophase. *(Menofia 2015)* ( )

21. The ratio of number of cells produced due to the 3rd division to number of cells produced due to the 2nd division of a somatic cell equal $\frac{6}{2}$ ( )

22. Meiotic division happens in somatic cells. *(Alex. 2018)* ( )

23. 📖 Meiosis results in the formation of two cells, each contains half the genetic material of the parental cell. ( )

24. 📖 Gametes in living organisms are produced by special cells known as the somatic cells during the meiotic division. ( )

25. 📖 Reproductive cells are divided by mitosis which leads to the formation of gametes. ( )

26. 📖 Meiotic cell division aims to the production of the gametes. *(South Sinai 2019)* ( )

27. The meiotic cell division leads to the growth of living organisms. *(Luxor 2018)* ( )

28. First meiotic division aims to reduce the chromosomal number to half. ( )

29. At the end of telophase I, two cells are formed, each contains half the number of chromosome of the parental cell. ( )

30. In the final phase of meiosis, the number of produced cells equals to quarter of the number of that are produced by mitosis. *(Cairo 2018)* ( )

31. Crossing over phenomenon occurs in the anaphase of first meiosis. *(Qena 2016)* ( )

Write the scientific term of each of the following :

1. They are thread like bodies that have the main role in cell division. *(Kalyoubia 2020)*

2. The part in the cell which is responsible for cellular division. *(Port Said 2019 / Sohag 2020)*

3. • It consists of two chromatids connected together at centromere. *(Port Said, Red Sea 2018)*

   • Chemically, it consists of nucleic acid DNA and protein. *(Giza 2015 / Beni Suef 2019)*

4. The point of connection of two chromatids together of the chromosome during the cell division. *(Qena 2019 / Red Sea 2020)*

5. The nucleic acid that carries the genetic traits of the multicellular living organisms.

   (Gharbia 2017 / Giza 2019)

6. A process through which the living cell divides into two cells or more to aim the growth or reproduction.

7. • ⬚ A cell division that occurs in the somatic cells and results in the growth of the living organism. *(South Sinai / Assiut 2019)*

   • A kind of cell division that occurs in somatic cells and leads to the compensation of the damaged cells. *(Luxor 2014)*

8. ⬚ A phase in which some important vital processes occur to prepare the cell for division and the genetic material in the cell is doubled. *(Beni Suef, Assiut 2020)*

9. The phase of mitotic division in which the nucleolus disappears.

10. The part which is responsible for pulling the chromosomes towards the two poles of the cell during anaphase of cell division. *(Damietta 2020)*

11. Fibers extend between the two poles of the cell in prophase. *(Red Sea, Menia 2019)*

12. ⬚ A phase in which the chromosomes migrate towards the cell equator where each chromosome is connected with one of the spindle fibers at the centromere. *(Ismailia 2017)*

13. The phase in which some processes (a series of adverse changes) occur which lead to the formation of a complete set of chromosomes that equal in numbers with the mother cell's chromosomes. *(Assiut 2018 / Menofia 2019)*

14. • Cellular division which leads to the formation of gametes. *(Assiut 2020)*

    • Cellular division that produces sperms and ova. *(Alex., Minia 2016)*

    (Suez 2020)

15. Specialized cells which produce gametes.

16. • The cells resulting from meiotic division and have half number of chromosomes (N) of the original cell. *(Suez, Red Sea 2017)*

    • Are produced from cells known as reproductive cell inside living organisms.

    (Fayoum 2020)

17. They are an arrangement of homologous pairs of chromosomes where each pair consists of 4 chromatides. *(Behira 2020)*

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18. • It occurs at the end of the first prophase of the meiosis, in which some parts of the two inner chromatids are exchanged. *(Port Said, Beni Suef 2017)*

• A process in which some parts of the two inner chromatids of each tetrad are exchanged. *(Giza, Damiette 2020)*

• ▢ It contributes in genes exchanging between the chromosomes' chromatids and distributing them in the gametes. *(Kalyoubia 2017 / South Sinai 2018)*

19. A dangerous disease occurs when the body cells are divided continuously without controlling. *(Menofia 2016)*

20. A mass of cells that produced due to the abnormal continuous division of cells. *(Menofia 2018 / Behira 2019)*

5. Complete the following statements :

1. .... and .... are two types of cells in the bodies of multicellular living organisms.

2. The hereditary material in the .... of the cell consists of a number of .... *(Ismailia 2019)*

3. The chromosome chemically consists of .... called .... and .... *(Minia, Damietta 2020)*

4. The nucleic acid is symbolized by .... which carries .... of the living organism.

5. The chromosome consists of .... connected together at a point known as .... *(Red Sea 2019 / Cairo 2020)*

6. The number of chromosomes is .... in the individuals of the same species, while it is .... from a species to another.

7. The male and the female gametes in the human body have .... number of chromosomes, while the somatic cells have .... number of chromosomes. *(Beni Suef 2014)*

8. Somatic cells are divided by .... , while reproductive cells are divided by .... *(Gharbia, Sharkia 2020)*

9. .... division occurs in liver cells. *(Giza 2020)*

10. .... division leads to the growth of the living organisms. *(Aswan 2018)*

11. The amount of the genetic material duplicates in a phase called .... *(Giza 2015)*

12. During prophase, ... intensifies and .... appears in the form of thin strings.

13. At the end of prophase of mitosis, the .... and .... disappear. *(Cairo 2020)*

14. In the animal cell, the spindle fibers are formed by .... , while in plant cell, the spindle fibers are formed from .... at the cell poles. *(Dakahlia, New Valley 2020)*

15. Chromosomes pairs arrange on the cell's equator in the .... phase. *(Gharbia 2018)*

16. The spindle fibers are formed during the cell division in the .... and disappear in the .... *(Assiut, Aswan 2020)*

17. During anaphase of mitosis, the .... splits lengthwise into two halves and the .... of each chromosome separate from each other.

18. During the .... phase of mitotic division a series of adverse changes occurs. *(Beni Suef 2020)*

19. A nuclear membrane is formed at each pole of the cell surrounding the chromosomes in the .... of the cell division.
(Port Said 2014)

20. .... division aims to form gametes.
(Sharkia 2016 / Sohag 2017)

21. In human, meiosis occurs in testes to produce ...., while it occurs in ovary to produce ....

22. In human and animals, meiosis occurs in .... to produce male gametes, while it occurs in .... to produce female gametes.
(Sharkia 2019)

23. Meiotic division occurs in the anther of the flower to form ....
(Menofia, Suez 2018)

24. In plants, male gametes are called .... , while female gametes are called ....
(Port Said 2020)

25. The gamete has a number of chromosomes equals to .... the number of chromosomes in the original cell.
(Kafr El-Sheikh 2017)

26. Meiosis takes place in two stages which are .... and ....

27. In flowering plants , the pollen grains are formed inside the .... , while the ovules are produced inside the ....

28. If the fertilized ovum contains 8 pairs of chromosomes this means that the unfertilized ovum contains .... chromosomes.
(Damietta 2020)

29. In prophase I, chromosomes are arranged in .... pairs, each pair consists of .... chromatids which are called ....

30. Each produced cell from meiosis contains .... the number of chromosomes of the parent cell, so it is called the .... division.

31. The cell which is divided by .... cell division gives 4 cells, while that is divided by .... gives 2 cells.

32. If the cell of liver in a rabbit contains 44 chromosomes, so the male gamete in a rabbit contains .... chromosomes and the female gamete contains .... chromosomes.

33. At the end of 1st. prophase of 1st. meiotic division, the phenomenon of .... occurs.
(Beni Suef 2020)

34. Crossing over phenomenon occurs at the end of .... of the .... division.
(South Sinai / Fayoum 2019)

35. Crossing over phenomenon happens between the .... during the meiosis. *(Alex. 2019)*

36. .... contributes in the exchange of genes that carry genetic traits and it works on the variation of genetic traits among the members of the same species. *(Dakahlia 2015)*

37. The Egyptian scientist Mustafa El Said discovered a way to detect the cancer cells by using ....
(Port Said 2019)

38. Nano-molecules of .... metal is used to detect cells of cancer and .... rays are used to destroy them.

39. The ability of the liver to regenerates under certain conditions if injured represents the scientific base for .... surgery.
(Menofia 2020)

6. Give a reason for each of the following sentences :

1. Chromosome is considered as the genetic material for the cell.
   (Gharbia, Red Sea 2020)
2. Cellular division begins with interphase.
   (New Valley 2019)
3. Duplicating the genetic material in interphase for cell division.
4. Somatic cell differs from reproductive cell.
5. The difference in the way of formation of spindle fibers in plant cell than in animal cell.
   (Kalyoubia 2017)

6. Shrinking of spindle fibers during the anaphase of mitosis division.
   (Aswan 2018 / Giza 2019)

7. The changes that occur in telophase of mitotic division are called adverse changes.
8. The damaged nerve cells can't be compensated.
9. A donor for a part of the liver suffers no harm and can survive. *(Kalyoubia, Behira 2019)*
10. Meiotic division is called by reduction division. *(Kalyoubia, Gharbia 2019)*
11. The gametes are often (N), while somatic cells are often (2N). *(Menofia 2020)*
12. Meiosis is considered as the source of genetic variation on which the variation of living organisms depends on.
13. • Crossing over is the source of genetic variation between members of the same species.
    (Ismailia 2017 / Menofia 2019)

    • The importance of occurrence the crossing over phenomenon. *(Ismailia 2018 / Suez 2020)*
14. Mitotic division is important for children than meiosis. *(Kalyoubia, Damietta 2020)*
15. Exictense of the centrosome in the animal cells. *(Menofia 2016 / Matrouh 2017)*
16. Nano-technology is called by this name.
17. Laser is used for treatment of cancer by Nano-technology.
18. The technic of discovering the cancer cells by using the Nano-molecules of gold depends on using a special protein.
    (Luxor 2019)

7. What is meant by ... ?

1. Chromosomes.
2. 📖 The DNA. *(Behira, Red Sea 2017)*
3. Centromere. *(Qena 2017 / Fayoum 2020)*
4. Cell division.
5. Spindle fibers during cell division. *(Kalyoubia 2019)*
6. Mitosis.
7. 📖 Somatic cells.
8. The interphase. *(Luxor 2016 / Red Sea 2018)*
9. Meiosis.
10. Meiosis division is a reduction division. *(Giza 2020)*
11. Crossing over phenomenon. *(Minia 2019 / Red Sea 2020)*
12. Tetrad. *(Giza 2019 / Gharbia 2020)*

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8. Mention the importance of each of the following :

1. Chromosomes.
2. Centromere.   *(Luxor 2017 / Menofia 2020)*
3. • Nucleic acid (DNA).
   • Nucleic acid in the chromosome structure.   *(Red Sea 2019 / New Valley 2020)*   *(Alex 2020)*
4. Mitosis in the somatic cells of organisms.   *(Kafr El-Sheikh 2018 / Qena 2019)*
5. Spindle fibers.   *(Menofia 2020)*
6. Centrosome in the animal cell.   *(Qena 2020)*
7. Meiosis division of reproductive cells.   *(Giza, Red Sea 2017 / Ismailia 2018)*
8. Anther in the flowering plants.   *(Alex. 2020)*
9. Crossing over phenomenon.   *(Alex. 2018 / Dakahlia 2020)*
10. Nano-molecules of gold.   *(Damietta, Luxor 2017 / Minia 2018)*
11. Proteins that are loaded on gold molecules.
12. Laser in treating cancer by Nano-technology.

9. What happens if ... ?

1. The nucleus of the cell is removed.   *(Aswan 2015 / North Siani 2020)*
2. The interphase before cell division does not occur.   *(Ismailia 2017)*
3. The centrosomes disappear from the animal cell.   *(Luxor 2019 / Sohag 2020)*
4. The parts of the inner chromatids are exchanged in the first prophase.   *(Aswan 2019)*
5. Reproductive cells don't divide by meiosis.   *(Fayoum 2020)*
6. Crossing over phenomenon doesn't occur.   *(Kalyoubia 2017 / Luxor 2020)*
7. A liver gets injured or cutting a part of it.   *(Damietta, Minia 2019)*
8. Donated a part of your liver to a sick person.   *(Damietta 2015)*
9. Focusing laser on golden Nano-particles in the cells infected by cancer.   *(Kalyoubia 2019)*

10. What are the results of ... ?

1. Somatic cells divide mitotically in the human body.   *(New Valley 2015)*
2. Each two homologous chromosomes come close to each other to form tetrad.
3. The parts of the inner chromatids are exchanged in the first prophase.   *(Behira 2019)*
4. • Meiotic division of reproductive cells occurs in human body.   *(New Valley 2016 / Port Said 2018)*

   • Reproductive cells are divided by meiosis.   *(Sharkia 2018)*
5. The meiosis division inside the anther and the ovary of a flower.   *(Alex 2019)*
6. Crossing over occurs at the end of prophase in meiotic division.   *(Luxor 2018)*

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11. Compare between :

1. Animal cell and plant cell [concerning : formation of spindle fibers].   *(North Siani 2020)*
2. Somatic cells and gametes [according to : the number of chromosomes].   *(Fayoum 2016)*
3. Somatic cell and reproductive cell [according to : the kind of division - number of chromosomes for each cell - location - number of resulting cells].

    (Cairo, Dakahlia 2020)
4. Male gamete and female gamete [concerning an example for each of them].

    (Beni Suef 2020)
5. Anther in the flowering plants and ovary in human body [according to : the name of their gametes which they produce].   *(Dakahlia 2018)*
6. The prophase in mitotic cell division and first meiotic division.   *(Beni Suef 2014)*
7. The metaphase in mitotic cell division and first meiotic division. *(Luxor 2018 / Matrouh 2019)*
8. The metaphase in first meiotic division and second meiotic division (by drawing only).

    (Sharkia 2018)
9. The anaphase in mitotic cell division and first meiotic division.   *(North Sinai 2016)*
10. 📖 Meiosis and mitosis [according to : the purpose of the division - site of occurrence - division phases - division results].   *(Red Sea 2018 / Kafr El-Shiekh 2019)*

12. Mention one difference between :

1. Centrosome and centromere.
2. The anther in plant and the testis in animal.

13. Show by drawing each of the following and write down the labels as possible :

1. The structure of the chromosome.
2. Interphase in mitosis division.   *(Sharkia 2019)*
3. The phases of mitotic cell division.
4. Metaphase in the mitotic division.   *(Qena 2016 / Kafr El-Sheikh 2018)*
5. Anaphase in the mitotic division.
6. The phases of meiotic cell division.
7. Anaphase I for meiosis division.   *(Dakahlia 2019)*
8. Metaphase I in the first meiotic division.   *(Port Said 2015)*
9. Anaphase in the second meiotic division.   *(Kafr El-Sheikh 2014)*
10. Crossing over phenomenon.   *(New Valley 2020)*

14. Variant questions :

1. **Mention the general structure of the chromosome, show your answer by drawing and label it.**

    (Dakahilia 2020)
2. **A cell has (2N) chromosomes in its nucleus and it is divided meiotically. How many cells are produced from such division and how many chromosomes are in its nucleus ?**

3. Two cells are divided, one in a female (uterus or stomach) and another in her ovary ... Mention :
    (Damietta 2020)
    a. Kind of cell division in each cell and the aim of division.
    b. Number of cells produced from each division and number of chromosomes in each resultant cell.
    (Luxor 2018 / Fayoum 2019)
    c. Show by drawing the metaphase in uterus cell or stomach cell.

4. Two cells are divided, one of them is in the plant stem and the other is in the plant ovary, if you know the number of chromosomes in each of them is 6 pairs of chromosomes, Mention :
    (Gharbia 2019)
    a. The kind of cell division in each cell.
    b. The number of chromosomes in each resulted cell.

5. If you know that there are two types of cell division, one of them includes the following phases : Anaphase - Metaphase - Telophase - Prophase.
    a. Arrange the previous phases according to their successive occurrence.
    b. What is the type of division which include these phases ?   *(Suez / New Valley 2019)*

6. What is the name of the phase, where the following changes occurs during cell division :
    a. Chromosomes are arranged along the equator of the cell.
    b. Doubling the genetic material.   *(Giza, Sharkia 2020)*

7. If you have two plant cells, one of them is divided meiotically and the other is divided mitotically. Answer the following questions :
    a. Mention in which parts of a plant does the two divisions occur ?
    b. What is the importance of each division ?

8. If the number of chromosomes in liver cells of a living organism is 32, what is the number of chromosomes in its reproductive cells ?   *(Aswan 2018)*

9. If the number of the chromosomes in a sperm of an animal is 16 chromosomes. What is the number of chromosomes in each of the following ?
    a. The zygote.   b. A cell in the liver.   c. A gamete.   *(Suez 2015)*

10. If the number of chromosomes in a human pancreatic cell is 23 pairs of chromosomes. What is the number of chromosomes in the following cells ?
    a. Skin.   b. Sperm.   c. Fertilized ovum.

    (Sohag / Luxor 2019)

11. If the number of chromosomes in the liver cells of an animal is 40 chromosomes so, what is the number of chromosomes in the following ?   *(Alex. 2015)*
    a. Muscle cells.   b. Sperm cells.   c. Skin cells.

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12. If the number of chromosomes of a rabbit's liver cell is 22 pairs of chromosomes. What is the number of chromosomes in the following cells ?   *(Behira 2015)*

   a. Sperm.   b. Fertilized ovum.

13. Which of the following organs show the right numbers of chromosomes :

(Kalyoubia 2020)

The choice	a	b	c	d
The organ	liver	testes	uterus	ovaries
Its cells has (2n)	✓	✗	✗	✓
Produce cells has (n)	✓	✓	✓	✓

14. Show by drawing and write short notes about prophase I in the first meiotic division.   *(Sharkia 2019)*
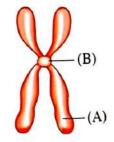
15. ▢ Explain using drawing the crossing over phenomenon and its role in the variation of genetic traits among the members of the same species.

16. Name the phase that indicates the following changes during the cell division :

   a. Form two separate groups of chromatids.

   b. Disappearing of nucleolus and the nuclear membrane.   *(Alex. 2019 / Kalyoubia 2020)*

17. What's the scientific base of liver transplantation ?

18. Mention the name of the scientist who discovered a way to use Nano-molecules of gold to detect the cancer, Explain that way.   *(Menofia 2017)*

15. Study the following figures, then answer the questions :

1. From the opposite figure, complete the following :

   a. Letter (A) represents ....

   b. Letter (B) represents ....

   c. In which phase of mitosis, the part (B) splits lengthwise into two halves ?   *(Dakahlia 2016 / Menofia 2017)*

                                  —(B)

                                    —(A)

2. From the opposite figure, answer the questions :

   a. When does this phase happen ?

   b. Why does the cell passe through this phase ?   *(Minia, Sharkia 2020)*

3. The figure in front of you shows a phase of cell division, answer the following :

   a. What is the type of this division ?

   b. What is the name of this phase ?

   c. What is the importance of this type of division ?   *(Assiut, Sohag, Qena 2020)*

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4. **Through your study the stages of mitotic division answer the following :**
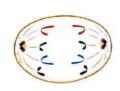
   a. Name the phase that precedes this phase in the figure.

   b. In which phase is the centromere of each chromosome split lengthwise into two halves ?

   c. In which phase is the spindle fibers disappear ?

   d. What is the importance of interphase ?   *(Beni Suef 2019)*
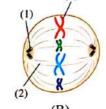
5. **Examine the opposite figures, then answer the following questions :**   *(Beni Suef 2020)*
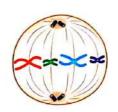
   a. Identify phases (A) & (B).

   b. What is the difference between the two phases ?

   c. What are the changes which occur in phase (A) ?

   d. Write the labels on phase (B).

6. **Look at the opposite figure which represents one of the phases of the cell division :**

   (Ismailia, North Siani 2020)

   a. What is the name of this phase ?

   b. What is the type of the cellular division it belongs to ?

   c. What is the function of the centrosome in this division ?

   d. What happens to the two chromatids of each chromosome during anaphase ?

   e. In which type of cells does such division occur ?

7. **The opposite figure shows one of the phases of the mitosis, answer the following questions :**

   (Aswan 2017 / Ismailia 2018)

   a. What is the name of this phase ?

   b. What happens if the centrosome is not found ?

   c. Draw the diagram of the following phase.

8. **From the opposite figure answer the following :**   *(Giza 2017 , 2018)*
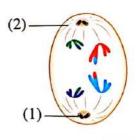
   a. What is the name of the division phase represented by this figure ?

   b. What is the most important phenomenon that occurs in it ? and what is its importance ?

   c. Draw the diagram of phase next to this phase.
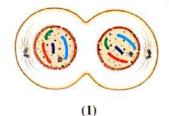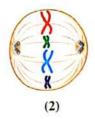
9. **Look at the opposite figure, then answer the questions :**

   a. Complete the labels on the figure.

   b. What does this figure represent ? and to which type of cell division does it belong ?   *(Damietta 2020)*

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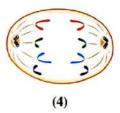
10. Name only these stages of mitosis :

(1)　　　　　　(2)　　　　　　(3)　　　　　　(4)
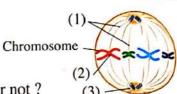
11. Study the opposite diagram which takes place in a somatic animal cell, then answer the following : *(Suez 2016, 2017, 2020)*

a. What is the name of this phase ?

b. How was structure number (1) formed ?

c. Write the number which refers to the centromere.

d. By the end of this phase, are the centromeres going to split or not ?

12. Look at the opposite figure which represents a phase in a meiotic division, then answer the following questions : *(Port Said, Damietta 2019)*

a. Mention the name of this phase.

b. Draw the phase which follows this phase.
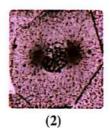
13. 📖 The following microscopic images illustrate the first meiotic division phases :

a. Identify each phase. *(Dakahlia 2015)*

b. Arrange these phases according to the periority of occurrence.

(1)　　　　　　(2)　　　　　　(3)　　　　　　(4)
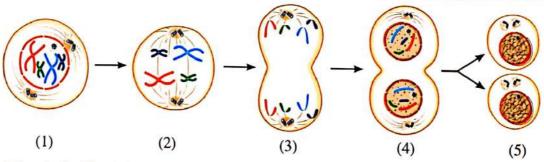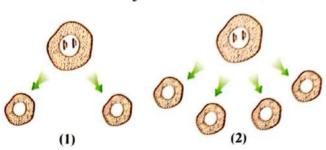
14. Look at the following figures, then answer the following : *(Sohag 2017 / Menia 2019)*

(1)　　　(2)　　　(3)　　　(4)　　　(5)

a. What is the kind of cell division in these figures ?

b. What is the name of phases number (2) and (3) ?

c. What will disappear in phase number (1) ?

15. The opposite figures represent the division of two cells by two different ways :

   a. - Mention the kind of division in case (1) and (2).

     - Showing the place of occurrence of each of them.

   b. What is the importance of each kind of division ?

(1)   (2)
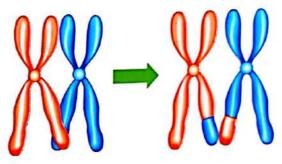
   c. Mention the organ in which the division (2) occurs in each of :

     A. The human.   B. The plant.

   d. Mention the number of chromosomes for each produced cell in case (2) knowing that the number of chromosomes in the mother cell is 20 chromosomes.

   e. The division in case (2) occurs in two steps which are the .... division and the .... division.

16. 📖 **Explain the following phenomenon, state what is its importance and :**

   a. In which phase does it occur ?

   b. What's the type of its division ?

   c. Draw the following phase to the phase in which this phenomenon occurs.

(Alex., Kalyoubia, Aswan 2020)

Scanned with CamScanner

Timss Questions
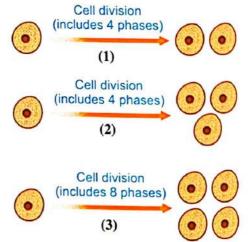
1. Choose the correct answer :

1. After occurrence seven successive mitotic divisions, ... cells are produced.

   a. 32   b. 64   c. 128   d. 192

2. If each cell of muscle cells in a female rabbit contain 22 pairs of chromosomes, so the number of chromosomes present in two ovarian cells equal .... chromosomes.

   a. 2   b. 22   c. 44   d. 88

3. If an ovum of a species contains 3 chromosomes, so its liver cell when divided, each one of the new resulted cells will contain ....

   a. 3 chromatids.   b. 3 pairs of chromatids.

   c. 6 chromatids.   d. 6 pairs of chromatids.

4. The ratio between the number of chromosomes in a pollen grain to the number of chromosomes in a root cell of one of flowering plants is .... one.

   a. less than   b. more than   c. equal to   d. twenty

5. 23 pairs of chromosomes containing ....

   a. 46 chromatids.   b. 92 chromatids.

   c. 46 centromeres.   d. (b) & (c) are correct.

2. Study the opposite figures, then answer :

(Behira, South Sinai 2020)
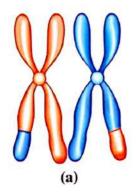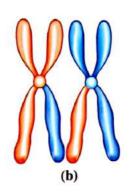
1. Which shape has a scientific mistake ? Why ?

2. Mention the type of division in the right figures.

3. **Which division :**

   a. Reduces the number of chromosomes to half.

   b. Produces the repairing cells of wound.

   c. Produces sperms.

   d. Causes genetic variation between living organisms.

Cell division (includes 4 phases) (1)

Cell division (includes 4 phases) (2)

Cell division (includes 8 phases) (3)

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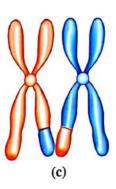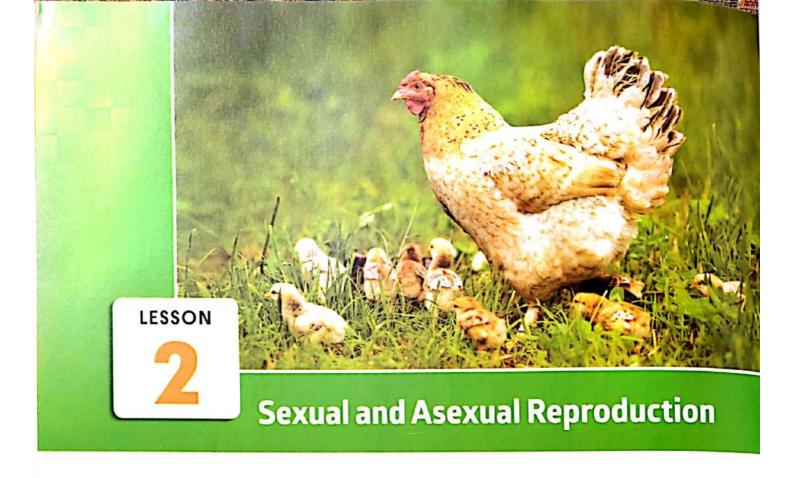
3. If you know that one cell of your liver is divided two times, 4 cells are produced. Answer the following questions :

1. What is the type of division that occur for this cell ?
2. What is the type of cell ?
3. Does the number of chromosomes change from the parent cell ? why ?
4. Does the shape of resultant cells change ? Why ?

4. Which one of this the following 3 figures, represent the crossing over phenomenon ? give a reason for your answer.

(a)   (b)   (c)

5. Which type of cell division (mitotic or meiotic) takes place in an abnormal cell to form a cancer tumor ?

6. What is the difference between metaphase of mitotic division and that of second meiotic division ?

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Sexual and Asexual Reproduction

How do living organisms keep their species from extinction ?

Not all living organisms are reproduce by the same way, in order to keep the continuity of their species and to avoid their extinction.

Reproduction process

It is a biological process, where the living organism produces new individuals of the same kind and thus, ensuring its continuity.

Importance of reproduction

It produces new individuals of the same kind and preserves them from extinction.

Types of reproduction

First
Asexual reproduction

- It occurs by only one living organism.

- It mostly occurs in single-celled living organisms (such as yeast and amoeba).

Second
Sexual reproduction

- It occurs through two living organisms, one is a male and the other is a female.

- It occurs in most higher living organisms (such as plants, animals and human).

FIRST / Asexual reproduction

Asexual reproduction

It is a process by which a living organism produces new individuals with genetic traits identical to those of their parent.

⊙ **It occurs in :**

- **Unicellular (single - celled) living organisms.**

  Such as : Yeast, bacteria and amoeba.

- **Some multicellular animals and plants.**

  Such as : Hydra, mushroom and starfish.

⊙ **Properties of asexual reproduction :**

1. It takes place by only one living organism.

2. It does not require special systems or structures in the living organism.

3. It takes place by mitotic division.

4. It keeps the genetic structure of the living organism. **GR**
   Because it produces new individuals (offspring) identical in genetic structure to the original living organism during mitotic division.

So, these new offspring get a full copy of the parent genetic traits without the occurrence of any genetic variation.

So, there are no differences in the resulting offspring from the original organism.

Note

If the number of chromosomes in the parental cell is (2N), the number of chromosomes in the offspring is (2N).

GR | **Asexual reproduction needs neither special systems nor structures to occur.**
   Because it takes place by mitotic division only through one individual.

Types of asexual reproduction

| 1 Reproduction by binary fission | 2 Reproduction by budding | 3 Reproduction by regeneration | 4 Reproduction by spore propagation | 5 Vegetative reproduction |

1 Reproduction by binary fission :

⊙ It occurs in :

Unicellular living organisms as :
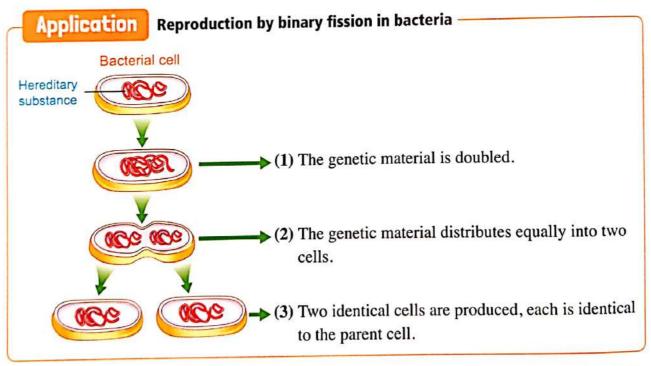
• **Unicellular protozoans.**
  Such as : Amoeba – Paramecium – Euglena.

• **Simple algae and bacteria.**

Amoeba

How does the reproduction by binary fission occur ... ?

➲ The nucleus divides by mitotic division and the cell splits into two cells.

➲ Each cell grows and becomes a new individual.

Application Reproduction by binary fission in bacteria

Bacterial cell

Hereditary substance

(1) The genetic material is doubled.

(2) The genetic material distributes equally into two cells.

(3) Two identical cells are produced, each is identical to the parent cell.

❋ **From the previous application, we can define reproduction by binary fission as follows :**

Reproduction by binary fission
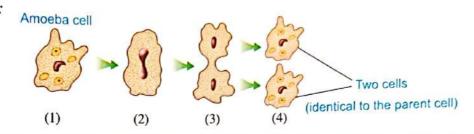
It is a type of asexual reproduction where the nucleus divides mitotically, then the cell splits into two identical cells.

GR.
- *The cells that are resulted by binary fission are identical to the parental cell.*
  Because they are resulted by the mitotic division.

- *The parent cell which reproduces by binary fission disappears.*
  Because it splits into two identical cells.

Enriching activity

Binary fission in amoeba :

Amoeba cell

(1)   (2)   (3)   (4)

Two cells
(identical to the parent cell)

2 Reproducting by budding :

⊙ It occurs in :

- **Unicellular organisms.**
  Such as : Yeast fungus.

- **Multicellular organisms**
  Such as : Hydra and sponges.

Budding
in yeast fungus

Budding
in hydra

Budding
in sponge

How does reproduction by budding occur in a yeast fungus ... ?

Activity To discover reproduction in a yeast fungus :

Materials and tools :
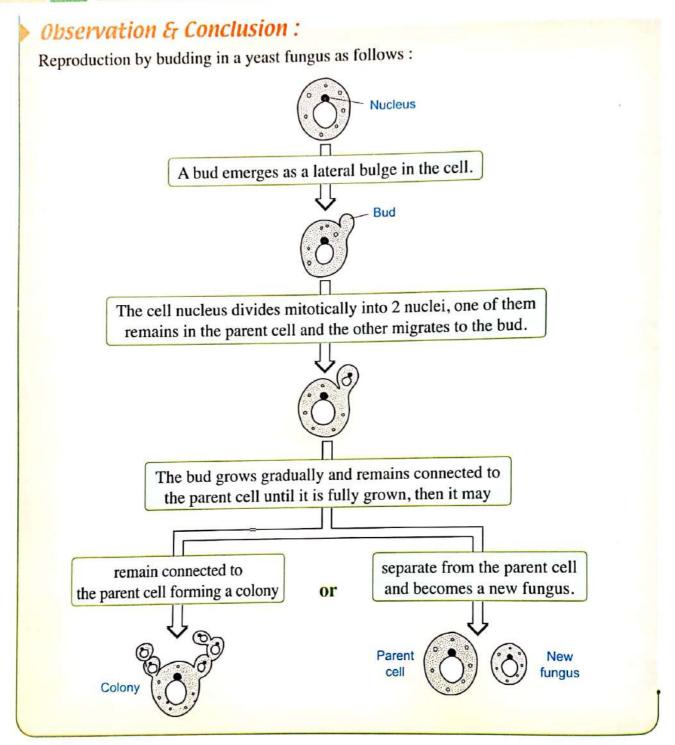
- A piece of yeast.
- A glass slide.
- Sugary solution.
- Cover slips.
- Warm water.
- A teeth stick.
- Microscope.

Steps (procedures) :

1. Add 1 ml of sugary solution and 4 ml of warm water to 2 ml of yeast in a plate and leave them in a warm dark place for 10 min.
2. Put a drop from the mixture on a glass slide. Then, place the cover slip gently.
3. Examine the slide under the microscope and record what do you observe.

▶ *Observation & Conclusion :*

Reproduction by budding in a yeast fungus as follows :

Nucleus

A bud emerges as a lateral bulge in the cell.

Bud

The cell nucleus divides mitotically into 2 nuclei, one of them remains in the parent cell and the other migrates to the bud.

The bud grows gradually and remains connected to the parent cell until it is fully grown, then it may

| remain connected to the parent cell forming a colony | **or** | separate from the parent cell and becomes a new fungus. |

Colony

Parent cell   New fungus

✷ **From the previous activity, we can define reproduction by budding as follows :**

Reproduction by budding

It is a type of asexual reproduction that produces new individuals by formation of buds in the parent cell.

3 Reproduction by regeneration :

⊙ It occurs in :

Multicellular living organisms.

Such as : Starfish.

Central disc

Arms

Starfish with many arms arises from a central disc

How does reproduction by regeneration occur ... ?

It occurs by growing of a cut part from the body of living organism by mitotic division forming a new complete organism.

Application Regeneration and reproduction by regeneration in starfish

When a starfish loses one of its arms, SO

(The missing part)

(The remaining part)

The missing part of the animal can grow forming a complete animal, if it contains a part of the central disc and this is known as reproduction by regeneration.

The remaining part of the animal can form a new arm instead of the missing one, and this is known as regeneration.

Reproduction by regeneration

It is the ability of the missing part in some living organisms to grow forming a complete organism identical to the parent individual.

Regeneration

It is the ability of animals to compensate their missing parts.

Note

If the number of chromosomes in cells of starfish is (2N), the number of chromosomes in cells resulted by regeneration is (2N) too , because regeneration is asexual reproduction that occurs by mitotic division.

4 Reproduction by sporogony (Spore propagation) :

⊙ **It occurs in :**

- **Some fungi.**

  Such as : Bread mould and Mushroom.

- **Some algae.**

Mushroom fungus

How does reproduction by spore propagation occur ... **?**

Application

Spores are found in the bread mould fungus inside special organs which are called **sporangium (pl. sporongia).**

When spores be mature

The sporangium ruptures and a large number of spores are released.

When spores fall on a suitable environment

Each spore grows by mitotic division to give new organisms (fungus) identical to the parent.

Reproduction by sporogony (spore propagation) in bread mould fungus.

✴ **From the previous application, we can define the reproduction by spore propagation as follows :**

Reproduction by spore propagation

It is a type of asexual reproduction that occurs in some fungi and algae by producing spores.

? Exercise

Answer the following :

(1) What will each spore cell give if it is placed on a wet bread again ?

(2) What is the type of cell division in this reproduction ?

Answer

(1) New fungus.   (2) Mitotic division.

5 Vegetative reproduction :

⊙ It occurs in :

Plants' vegetative organs.

(Such as : leaves, roots and stems) in order to produce new plants identical to the parent plant.

Each potato tuber can form a new plant

Note

Vegetative reproduction occurs without the need of seeds.

How does the vegetative reproduction occur ... ?

Vegetative reproduction in plants occurs by mitotic division where it happens:

Naturally : By plant's vegetative organs (leaves, roots and stems).

Artificially : In many ways such as tissue culture.

❋ From the previous explanation, we can define the vegetative reproduction as follows :

Vegetative reproduction

It is a type of asexual reproduction that takes place in plants' vegetative organs without the need of seeds.

SECOND Sexual reproduction

Sexual reproduction

It is a process by which a living organism produces new individuals with traits differ from parents.

⊙ It occurs in :

Most multicellular (higher) living organisms of plants and animals.

⊙ Properties of sexual reproduction :

1. It occurs between two parental individuals, one of them is a male and the other is a female.

2. It takes place by special reproductive organs and systems.

3. It takes place by meiotic division.

4. • It doesn't keep the genetic structure of the living organism.

 • Sexual reproduction is a source of genetic variation. GR.

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Due to the occurrence of the crossing over phenomenon during the formation of gametes through the meiotic division.

And also the offspring resulted from the sexual reproduction gets his genetic traits from two sources (the male and the female).
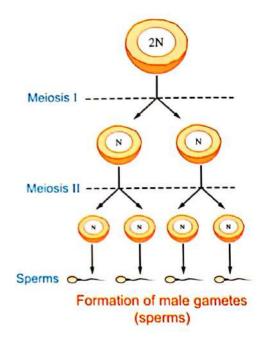
i.e. The resulted offspring has new genetic traits that combine the parents' traits.

⊙ It depends on two main processes :

1. Gametes formation.

2. Fertilization.

1 **Gametes formation :**

- Gametes of a male and a female are formed in the living organism as a result of the meiotic division for its reproductive cells.

- Gametes contain a half number of the chromosomes (N) of the organism's reproductive or somatic cells (2N).

Meiosis I

Meiosis II

Sperms

Formation of male gametes (sperms)
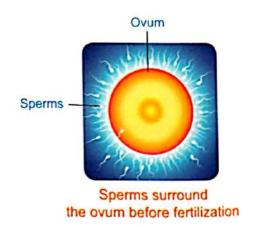
2 **Fertilization :**

Fertilization

It is the combination of a male gamete (N) and a female gamete (N) to form a zygote (2N).
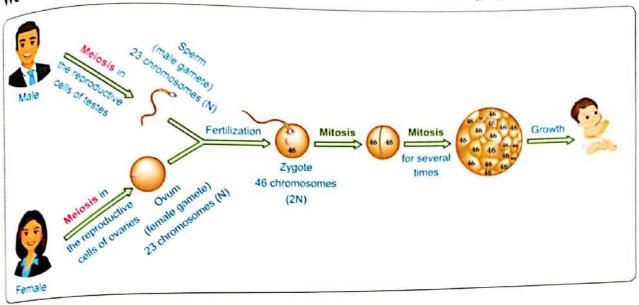
The zygote contains genetic material from both parents and when it grows, it gives a new offspring with genetic traits of its parents.

Ovum

Sperms

Sperms surround the ovum before fertilization

The zygote

It is a cell produced due to fertilization and it contains the complete number (diploid number) of chromosomes of the living organism.

We can summarize the sexual reproduction process in the following figure :

GR. *The number of chromosomes is constant in the same species which reproduce sexually.*

Due to meiosis division (which reduces the number of chromosomes) in gametes, then the combination of male gamete (N) and female gamete (N) to form the zygote which contains the whole number (diploid number) of chromosomes (2N).

➲ Comparison between sexual and asexual reproduction :

Sexual reproduction	Asexual reproduction
- It occurs by two living organisms, one of them is a male and the other is a female.	- It occurs by one living organism.
- It occurs in most (multicellular) higher living organisms of plants and animals.	- It mostly occurs in (unicellular) single-celled living organisms.
- It depends on meiotic division.	- It depends on mitotic division.
- It requires special reproductive organs and systems in the living organism.	- It doesn't require special systems or structures in the living organism.
- The new offspring combines the genetic traits from two sources (the male and female).	- The new offspring gets a full copy of the parent individual's genetic traits.

TRY To answer worksheet

- General Exercise of the School Book on Unit **4** **15**
- Model Exams on Unit **4** in the Notebook

Remember

⊙ Reproduction process :

It is a biological process, where the living organism produces new individuals of the same kind and thus ensuring its continuity.

⊙ Types of reproduction :

1. Asexual reproduction :

It is a process by which a living organism produces new individuals with genetic traits identical to those of their parent.

2. Sexual reproduction :

It is a process by which a living organism produces new individuals with traits that differ from parents.

⊙ Types of asexual reproduction :

1. Reproduction by binary fission :

- It is a type of asexual reproduction, where the nucleus divides mitotically, then the cell splits into two identical cells.
- It occurs in Simple algae, Bacteria, Amoeba, Paramecium and Euglena.

2. Reproduction by budding :

- It is a type of asexual reproduction that produces new individuals by the formation of buds in the parent cell.
- It occurs in Yeast fungus, Hydra and Sponges.

3. Reproduction by regeneration :

- It is the ability of the missing part in some living organisms to grow forming a complete organism identical to the parent individual.
- It occurs in starfish.

4. Reproduction by sporogony :

- It is a type of asexual reproduction that occurs in some fungi and algae by producing spores.
- It occurs in Bread mould fungus, Mushroom and some Algae.

5. Vegetative reproduction :

- It is a type of asexual reproduction that takes place in plants without need of seeds.
- It occurs by plants' vegetative organs (leaves, roots and stems).

⊙ Sexual reproduction depends on two main processes :

A. Gametes formation

B. Fertilization.

It is the combination of a male gamete (N) and a female gamete (N) to form a zygote (2N).

⊙ Zygote :

It is a cell produced due to fertilization and it contains the complete number (diploid number) of chromosomes of the living organism.

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Questions
on lesson two

1. Choose the correct answer :

1. Through reproduction process, ... transfer from parents to their offspring.
   a. genetic traits   b. organs   c. gametes   d. hormones

2. .... reproduction mostly occurs in single-celled living organisms.
   a. Sexual   b. Asexual   c. Mitotic   d. (a) and (b)

3. Asexual reproduction takes place by .... division.
   a. meiotic   b. reduction   c. mitotic   d. (a) and (b)

4. Bacteria reproduce by ....
   a. sexual.   b. spores.   c. vegetative.   d. binary fission.

5. Binary fission, budding, spore propagation and regeneration take place by ....
   a. mitosis.   b. meiosis.   c. fission.   d. sexual.

6. The binary fission of asexual reproduction occurs in ....   *(Kalyoubia 2020)*
   a. mammals.   b. euglena.
   c. reptiles.   d. the flowering plants.

7. Asexual reproduction occurs in the yeast fungus by ....   *(Cairo, New Valley 2018)*
   a. budding.   b. sporogony.   c. regeneration.   d. binary fission.
                                                                                (Menia 2019)
8. Amoeba reproduce by ....
   a. binary fission.   b. gametes.   c. regeneration.   d. budding.
                                                                    (Fayoum 2018 / Luxor 2020)
9. The reproduction by budding occurs in ....
   a. mushroom.   b. bread mould fungus.
   c. yeast fungus.   d. bacteria.

10. The parental individual disappears when the reproduction occurs in the ....
    a. bacteria.   b. yeast.
    c. bread mould fungus.   d. mushroom.   *(Matrouh 2017 / Sharkia 2020)*

11. The parental individual disappear during reproduction by ....
    a. sporangium.   b. regeneration.   c. binary fission.   d. budding.
                                                                    (Aswan 2019 / Fayoum 2020)

12. Asexual reproduction in hydra occurs by ....
    a. regeneration.   b. budding.   c. spore formation.   d. cutting.

13. The ability of some animals to compensate their missing parts is called ....
    a. budding.   b. sporangium.
    c. sexual reproduction.   d. regeneration.   *(Giza 2018 / Assiut 2020)*

14. The unicellular protozoans such as amoeba and paramecium reproduce by ....
    a. binary fission.   b. budding.   c. regeneration.   d. spores.
                                                                    (Menofia 2019 / South Siani 2020)

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15. A colony of yeast may be formed as a result of ....
    a. budding.   b. mitosis.   c. regeneration.   d. (a) & (b) are correct.

16. The type of asexual reproduction that occurs in some fungi and algae is the ....
    a. regeneration.   b. spore propagation.
    c. budding.   d. vegetative reproduction. *(Kafr El-Sheikh 2018)*

17. Starfish reproduces asexually by ....   *(South Sinai 2017)*
    a. regeneration.   b. binary fission.   c. budding.   d. spores.

18. If the chromosomal number in cells of starfish is (2N), the number of chromosomes in resulted cells is ....
    a. N   b. 2N   c. $\frac{1}{2}$ N   d. no correct answer.

19. Starfish arms could be regenerated and give a new animal if they contain a part of the ....
    a. bud.   b. zygote.   c. sporangium.   d. central disc.
    (Port Said 2018)

20. Bread mould fungus reproduces asexually by ....   *(Cairo 2020)*
    a. sporogony.   b. spore propagation.   c. binary fission.   d. regeneration.

21. Reproduction by spores occurs in all of the following organisms except ....
    a. starfish.   b. algae.   c. bread mould.   d. mushroom.
    (Kafr El Sheikh 2017 / Luxor 2018)

22. Asexual reproduction by spore propagation in fungi and algae occur by producing ....
    a. spores.   b. suckers.   c. cilia.   d. whips.
    (Behira 2018)

23. The reproduction by spores occur in this living organisms, except ....   *(Red Sea 2019)*
    a. amoeba.   b. bread mould fungus.
    c. mushroom.   d. no correct answer.

24. In the vegetative reproduction, the produced individuals are similar to their.........
    a. parent individual.   b. both parents.   c. the zygote.   d. no correct answer.

25. Spores are formed in some fungi inside a structure called ....
    a. bud.   b. zygote.   c. sporangium.   d. central disc.

26. The vegetative reproduction occurs in plants without need of ....
    a. stems.   b. seeds.   c. leaves.   d. roots.
    (Ismailia 2017 / Matrouh 2018)

27. The process by which the living organsim produces new individuals with genetic properties similar (identical) to the parent individual is called ....
    a. sexual reproduction.   b. asexual reproduction.
    c. vegetative reproduction.   d. (b) and (c).

28. It is possible to produce new plants identical to the mother plant by ....   *(Alex 2020)*
    a. forming gametes.   b. fertilization.   c. budding.   d. tissue culture.

29. Sexual reproduction occurs in ....
    a. unicellular organisms.   b. higher plants and animals.
    c. plants only.   d. single-celled organisms.

30. In sexual reproduction, the male gamete fuses with female gamete to form.........
    a. the sporamgium.   b. the zygote.
    c. the nucleus.   d. the cytoplasm.

31. Gametes formation takes place in ....
    (Port Said, Qena 2014)
    a. asexual reproduction.
    c. regeneration.
    b. sexual reproduction.
    d. budding.

32. The type of reproduction that occurs between two individuals is ....
    a. asexual.   b. sexual.
    c. regeneration.   d. binary fission.

33. .... contains genetic material from both parents and grows to form an individual carries characters from both parents.
    (Red Sea 2016 / Kafr El-Sheikh 2020)
    a. The gamete   b. The zygote
    c. The cytoplasm   d. The chromosome

34. All the following cells contain full copy of genetic material except .... *(Kalyoubia 2018)*
    a. spore.   b. bud.
    c. zygote.   d. pollen grain.

35. The source of genetic variation is the .... reproduction.
    (Gharbia , Suez 2019)
    a. budding   b. vegetative   c. sexual   d. regeneration

2. Choose from columns (B) & (C) what suits it in column (A) :

1.

(A)	(B)	(C)
1. Asexual reproduction 2. Sexual reproduction 3. Reproduction by binary fission	a. occurs in unicellular living organisms b. occurs in multicellular living organisms c. occurs in higher living organisms d. occurs in unicellular and multicellular living organisms	A. as bacteria and amoeba. B. as yeast fungus and hydra. C. as human and flowering plants. D. as mushroom fungus.

2.

(A)	(B)	(C)
1. Euglena 2. Sponge 3. Mushroom	a. A higher animal b. A fungus c. A multicellular organism d. A unicellular protozoan	A. Reproduces by binary fission. B. Reproduces by spores. C. Reproduces by budding. D. Reproduces sexually.

3. Put (✓) or (✗), then correct the false ones :

1. Respiration process is a process of producing new individuals of the same kind. ( )
2. The types of reproduction are meiosis and mitosis. ( )
3. Asexual reproduction occurs by only one living organism. ( )
4. The unicellular protozoans reproduce by binary fission. *(Qena 2014)* ( )
5. Simple algae are divided by binary fission. *(Matrouh 2018)* ( )

6. 📖 Sexual reproduction maintains the genetic structure of the living organisms. ( )
   (Sohag 2014)

7. 📖 Amoeba is divided by the binary fission into two identical cells, each is similar to
   the parental cell. ( )

8. 📖 A bud emerges as a lateral bulge in the cell, then the cell nucleus divides meiotically
   into two nuclei, one of them remains in the parental cell and the other one immigrates
   to the bud. *(Matrouh 2018)* ( )

9. The starfish reproduces by regeneration. ( )

10. Yeast reproduces asexually by binary fission. *(South Sinai 2015)* ( )

11. Asexual reproduction of living organisms occurs mitotically. ( )

12. Asexual reproduction keeps the genetic structure of living organisms. ( )
    (Kalyoubia 2018)

13. 📖 The offspring resulted from the asexual reproduction has traits different from
    the original organism. *(Assiut 2015 / Sohag 2017)* ( )

14. The gametes are often (2N), while somatic cells are often (N). *(Assiut 2015)* ( )

15. Sexual reproduction takes place by gametes which are produced through mitosis. ( )

4. Correct the underlined words :

1. Euglena reproduces asexually by <u>budding</u>. *(Menia, Red Sea 2017)*
2. <u>Euglena</u> reproduces asexually by budding. *(Aswan 2019)*
3. Yeast fungus reproduces asexually by <u>regeneration</u>. *(Port Said 2018 / Damietta 2019)*
4. The starfish reproduces by <u>binary fission</u>. *(Fayoum 2017, 2018)*
5. The binary fission is considered as <u>meiotic</u> division. *(Aswan 2014)*
6. Amoeba is divided by <u>the budding</u> into two identical cells, each cell is similar to
   the parental cell. *(Alex., Fayoum 2019)*
7. Reproduction by spore propagation occurs in <u>paramecium</u>. *(Giza 2018)*
8. The reproduction by <u>budding</u> occurs in the unicellular living organisms only. *(Minia 2018)*
9. From unicellular living organisms that reproduces by budding is <u>hydra</u>. *(Sharkia 2015)*
10. The parent individual disappears during the reproduction by <u>sporogony</u>. *(Suez 2019)*
11. <u>Asexual</u> reproduction is a source of genetic variation. *(Port Said 2019)*
12. The sexual reproduction depends on two main processes which are <u>crossing</u> and
    fertilization.
13. Sexual reproduction takes place in plants by <u>spores</u>. *(Matrouh 2017)*
14. Reproduction by sporogony occurs in <u>starfish</u>. *(Giza 2019)*
15. To produce new plants identical to the original ones, the method of <u>cultivating seeds</u> is
    used. *(Alex. 2017)*
16. The <u>zygote</u> contains the half number of chromosomes present in the somatic cells of
    living organism.
17. Gamete contain <u>diploid</u> number of chromosomes. *(Giza 2020)*

18. The fertilized ovum is called the <u>ovary</u>.
19. <u>Pollination</u> is the combination of the female gamete and male gamete to form a zygote.
(New Valley 2019)
20. The cell produced due to fertilization is called <u>tetrad</u>. *(Menia 2019)*
21. In sexual reproduction, the male gamete fuses with female gamete to form <u>sporangium</u>.
(Assiut 2017)

5. Write the scientific term of each of the following :

1. • A biological process, where the living organisms produce new individuals of the same kind to ensure their continuity. *(Cairo, Behira 2019)*
   • The ability of living organisms to produce new individuals.
2. • ☐ A process in which living organisms produce new individuals with genetic traits identical to those of their parents. *(Menofia, South Sinai 2017)*
   • The type of reproduction that takes place by only one living organism. *(Qena 2015)*
3. • A type of asexual reproduction occurs in unicellular living organisms.
   • A type of asexual reproduction in which the nucleus divides mitotically (mitosis) and then the cell which represents the body of the unicellular organism splits into two cells.
4. The type of asexual reproduction in which a colony may be formed.
5. A structure emerges as a lateral bulge from the mother's cell and contains a nucleus.
(Cairo 2016 / Matrouh 2017)
6. The ability of some animals to compensate their missing parts. *(Cairo, Qena, Red Sea 2020)*
7. The ability of the missing part in some living organisms to grow forming a complete organism.
8. An animal consists of a central disc from which many arms arise.
9. Special organs inside which a large number of spores are found. *(Luxor 2020)*
10. Special organs for reproduction in algae and fungi. *(Alex 2020)*
11. The type of asexual reproduction occurs in yeast fungus and sponges. *(Port Said 2015)*
12. The most common asexual reproduction in fungi and algae.
13. Asexual reproduction takes place in some plants without needing seeds that is by their vegetative organs. *(Sohag, Sharkia 2020)*
14. The type of reproduction in which no genetic variation takes place.
15. • A process by which the living organism produces individuals with traits differ from parents. *(Matrouh 2015)*
    • The type of reproduction which is considered as a source of genetic variation.
    • The type of reproduction that occurs in higher multicellular organisms.
16. A process in which the fusion (combination) takes place between a male gamete and a female gamete to form a zygote. *(Qena, Fayoum 2019)*
17. Cells produced in higher living organisms from special cells known as reproductive cells through meiosis. *(Cairo 2017 / Kalyoubia 2018)*
18. Cells are specialized for forming gametes.

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19. • It is resulted from the combination of a male gamete and a female gamete and contains the diploid number of chromosomes (2N) of the living organism.

(Red Sea 2014 / Damietta 2019)

• It is a cell produced due to fertilization and it contains the complete number of chromosomes of the living organism. *(Minia, Luxor 2018)*

• It contains genetic material from both parent and during growth it gives new individual carries the traits of both parents. *(Beni Suef 2019)*

6. Complete the following statements :

1. The genetic traits pass from parents to offspring by .... process.

2. .... is a biological process, where the living organism produces new individuals of the same .... ensuring its continuity.

3. There are two types of reproduction in living organisms which are .... and ....

(Dakhalia 2018, 2019)

4. .... reproduction occurs by only one living organism.

5. .... reproduction is mostly occurs in unicellular living organisms and some .... animals and plants.

6. The sexual reproduction depends on two processes which are .... and ....

(Kafr El-Sheikh, North Siani 2020)

7. .... reproduction doesn't require neither special systems nor structures in the living organisms. *(Beni Suef 2019 / Dakahlia 2020)*

8. Binary fission, ... , ... , ... and vegetative reproduction are the types of asexual reproduction.

9. Paramecium reproduces asexually by ....

10. Yeast fungus reproduces asexually by .... *(Kafr El-Sheikh 2018)*

11. From the examples of the multicellular organisms reproduced by budding is ....

(Behira 2019)

12. In binary fission, the nucleus is divided by .... division and the cell splits into .... cells.

13. Parental individual disappears when reproduction occurs in .... *(Behira 2018 / Giza 2019)*

14. During asexual reproduction, the number of parents is ...., while it is ....during sexual reproduction.

15. Asexual reproduction takes place by .... in yeast fungus and by .... in bacteria.

(Alex. 2016 / Matrouh 2019)

16. In reproduction by budding, one of the two produced nuclei remains in the .... and the other migrates to the ....

17. When the buds remain connected to the parental cell, a .... is formed.

18. The new individuals produced by asexual reproduction have .... identical to their parents.

19. The yeast fungus reproduces by budding is considered as a type of .... reproduction.

(Suez 2017, 2020)

20. From the examples of living organisms reproduced by regeneration is ....
(Qena, South Sinai 2018)

21. Starfish reproduces asexually by .... *(Suez, Matrouh 2019)*

22. Asexual reproduction in the bread mould fungus happens by .... *(Aswan 2019)*

23. .... is the ability of animals to compensate their missing parts. *(Behira 2015)*

24. Asexual reproduction in mushroom happens by .... *(Alex. 2015)*
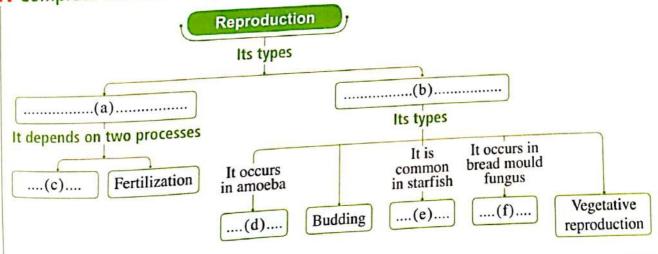
25. If the chromosomal number in the cells of starfish is (2N) , the number of chromosomes in the produced cells is ....

26. In .... fungus, sporongia have great numbers of .... which are released on rupturing of their wall.

27. Vegetative reproduction in plants happens by .... without the need of the ....
(Matrouh 2017 / Alex. 2018 / Suez 2020)

28. In plants, male reproductive organs are called .... , while female reproductive organs are called .... *(Red Sea 2017)*

29. The offspring resulted from .... reproduction have characters differ from their parents.

30. The gamete has number of chromosomes equals .... the number of chromosomes in the original cell.

31. The combination of the male gamete and female gamete to form the zygote is known as .... *(Assiut 2019)*

32. The fertilization process is the combination between .... and .... to form a zygote when it grows, it gives a new offspring. *(Red Sea 2019)*

33. After the growth of zygote by .... division, it produces a new individual that gains its genetic information from .... *(Matrouh 2017)*

34. When the male gamete fuses with the female gamete, ... is formed and it contains the .... number of chromosomes of the living organism. *(Giza 2016 / North Sinai 2019)*

7. Complete the following diagram :

Reproduction

Its types

................(a)................
It depends on two processes

................(b)................
Its types

....(c).... | Fertilization

It occurs in amoeba

It is common in starfish

It occurs in bread mould fungus

....(d).... | Budding | ....(e).... | ....(f).... | Vegetative reproduction

8. Give reasons for :

1. Reproduction is the way of living organisms to ensure the continuity of their species.

2. All types of asexual reproduction take place by only one individual.

3. Asexual reproduction needs neither special systems nor structures to occur.

4. • Asexual reproduction keeps the genetic structure of the living organism. *(Dakahlia 2020)*

   • Asexual reproduction produces offspring with genetic traits identical to those of their parent. *(Beni Suef 2020)*

5. Asexual reproduction depends on the mitotic division. *(Kalyoubia 2015)*

6. Binary fission is considered as mitotic division. *(Dakhalia 2018 / Alex 2020)*

7. The genetic material is doubled before the binary fission of the bacterial cell.

8. The parent cell which reproduces by binary fission disappears. *(South Sinai 2019)*

9. A colony may be formed through reproduction by budding.

10. Starfish continues alive even a part of its body is cut. *(Minia 2016)*

11. Starfish reproduces asexually by regeneration.

12. The number of chromosomes in cells resulted by regeneration is (2N) as in the parental cell.

13. Vegetative reproduction is called by this name.

14. Asexual reproduction in plants does not need the presence of gametes. *(Gharbia 2014)*

15. There are no new races (new individual with other trait) of plants (like grape), when they reproduce by vegetative reproduction. *(Damietta, Suez 2019)*

16. Spore propagation is a type of asexual reproduction which is common in some fungi such as bread mould and mushroom.

17. The sporangium of bread mould fungus must be ruptured during reproduction. *(Alex 2019)*

18. Sexual reproduction depends on the meiotic division. *(Behira 2018)*

19. The zygote has the same number of chromosomes of cells of parental organisms. *(Cairo 2017)*

20. The number of chromosomes is constant in the same species which reproduce sexually. *(Beni Suef 2019 / Behira 2020)*

21. Sexual reproduction is a source of the genetic variation between individuals. *(Giza, Qena 2020)*

9. What is meant by each of the following ... ?

1. Reproduction. *(Cairo 2020)*

2. Asexual reproduction.

3. Reproduction by binary fission. *(Kafr El-Sheikh 2015 / Sohag 2017 / Sharkia 2018)*

4. Reproduction by budding.

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5. Reproduction by sporogony (spore propagation). *(Sharkia 2019)*
6. Regeneration. *(Sohag 2018 / North Sinai 2019)*
7. Reproduction by regeneration. *(Alex 2020)*
8. Vegetative reproduction. *(Kafr El-Sheikh, Fayoum, Suez 2018)*
9. Sexual reproduction. *(Sohag 2020)*
10. Fertilization. *(Fayoum, Suez 2020)*
11. The combination of male gamete with female gamete to form a zygote. *(Luxor 2019)*
12. Zygote. *(Giza 2019 / Sohag 2020)*

10. Mention the importance or role of :

1. The reproduction process.
2. Asexual reproduction in producing offspring identical to their parents.
3. The central disc in the starfish. *(Sharkia 2015)*
4. Sporangium. *(Damietta 2017 / South Sinai 2018)*
5. Vegetative reproduction. *(North Sinai 2015)*
6. The sexual reproduction in the occurrence of the genetic variation.
7. Fertilization process.
8. Zygote.

11. Mention an example of :

1. A unicellular protozoan reproduces by binary fission.
2. A unicellular organism reproduces by budding.
3. An animal reproduces by regeneration. *(Assiut 2019)*
4. An organism reproduces by spores. *(Alex. 2018 / South Sinai 2019)*
5. A living organism reproduces sexually by two parents.

12. Compare between each pair of the following :

1. 📖 Asexual reproduction and sexual reproduction in view of each of the following : *(Sohag 2016 / Kalyoubia 2017)*
   a. Number of parents. *(Minia, Assiut 2020)*
   b. The genetic traits in the resulted offspring.
   c. The type of cell division involved.
2. Reproduction by budding and reproduction by regeneration. *(Assiut 2016 / Beni Suef 2017)*
3. Reproduction by budding and reproduction by sporogony. *(Dakahlia 2019)*
4. Amoeba and yeast fungus according to the type of asexual reproduction. *(Suez 2018 / Giza 2020)*
5. Pollen grain and sperm (according to site of formation). *(Giza 2019)*
6. Gametes and zygote.

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13. Mention one difference between :

1. Yeast fungus and hydra.
2. Yeast fungus and bread mould fungus.
3. Sponge and starfish.
4. Regeneration and reproduction by regeneration.
5. Spore and pollen grain.
6. Ovum and fertilized ovum.
7. Spore and zygote.

14. What would happen when ... ?

1. Euglena cell divides three successive mitotic divisions. *(Behira 2019)*
2. Putting a yeast fungus in a warm sugary solution. *(Fayoum, Gharbia 2020)*
3. The bud in the yeast fungus is separated from the parental cell. *(Minia 2020)*
4. ▥ Starfish loses one of its arms, while it contains a part of the central disc. *(Cairo / Qena 2019)*
5. Spores of bread mould fall on a wet piece of bread. *(Sharkia 2016 / Luxor 2017)*
6. Rupturing of the sporangium of bread mould fungus. *(New Valley 2019 / Sohag 2019)*
7. Absence of anther from the floral plants. *(Kalyoubia 2019)*
8. Cutting a part of a potato tuber and putting it in a suitable environment.
9. Fusion (combination) (integration) of sperm (male gamete) with an ovum (female gamete). *(Cairo, Giza 2020)*
10. No fusion occurs between male gamete and female gamete in the sexual reproduction. *(Suez 2018 / 2019)*
11. A kind of living organisms stops reproduction process. *(Fayoum 2018)*

15. What is the relation between the genetic structure of offspring and parents giving the reasons in each of the following cases ?

1. ▥ Binary fission in paramecium.
2. Spore propagation in yeast fungus.
3. The plant resulted vegetatively.
4. ▥ The plant resulted from germination of seeds.

16. Variant questions :

1. Mention two types of asexual reproduction. *(Giza 2015)*
2. Show by drawing each of the following and write down the labels as possible :
   a. Reproduction by budding in the yeast fungus. *(Dakhalia 2018)*
   b. Reproduction by binary fission. *(Behira, Fayoum 2016)*

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3. Explain the ability of the starfish to compensate their missing parts. *(Gharbia 2018)*

4. • ☐ Explain how sperms and ova are formed in the human being.
   • ☐ Explain by drawing, how are gametes produced by sex cells through the meiotic division.

5. Sexual reproduction in the higher living organisms depends on two main processes, mention them.
   (Dakahlia 2020)

6. Sexual reproduction is a source of genetic variation. Explain. *(New Valley 2018)*
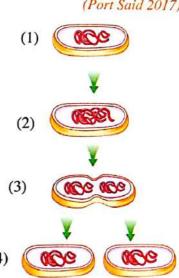
17. Study the following figures, and answer the following questions :

1. The following figure illustrates the reproduction process in one of living organisms :

   a. - What is the name of this process ?
      - What is the type of reproduction in this case ?

   b. What is the importance of this reproduction to the living organism in which it occurs ?
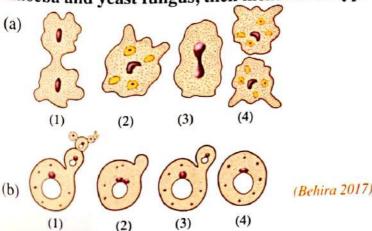
   (Port Said 2017)

2. The opposite figure shows the steps of an important process in bacteria :

   a. State the process illustrated in the figure ?

   b. What is the type of cell division that occurs through this biological process ?

   c. What is the difference between the steps no. (1) and (2) ?

   d. What is the relation between the genetic material in the cells shown in step (1) and step (4) ?

   (1)
   (2)
   (3)
   (4)

3. Rearrange the following figures to explain the process of asexual reproduction in amoeba and yeast fungus, then mention the type of reproduction in each organism :

   (a)
   (1) (2) (3) (4)

   (b) *(Behira 2017)*
   (1) (2) (3) (4)

Amoeba (a)	Yeast fungus (b)
(..................)	(..................)
(..................)	(..................)
(..................)	(..................)
(..................)	(..................)
Reproduces by	Reproduces by
....	....
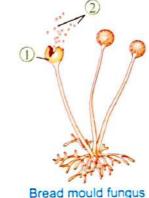
4. **The opposite figure shows a living organism :**

a. What is this living organism ?

b. Mention the type of its reproduction asexually.

c. **Complete :**

(1) The .... of this organism could be regenerated and give out a complete animal, if it contains a part of ....

(2) If the number of chromosomes in the parent cell (2N), the chromosomal number that produced in new individual cells after division .... (Why ?)

(Port Said 2015 / Beni Suef 2018)

5. **The opposite figure shows asexual reproduction in bread mould fungus :**

a. What is the type of asexual reproduction in a bread mould fungus ? And what is the division that this fungus depends on ?

b. Name structure No. ① in the figure and state its function.

c. - What are the released components No. ② ?

- When do they release ?

d. How can the components No. ② give new individuals of bread mould ?

e. Are the produced individuals identical to, or different from the original bread fungus ? Why ?

Bread mould fungus

(Behira, South Sinai 2016)

6. **From the opposite figures. Mention :**

a. The name of each figure.

b. The type of asexual reproduction for each one.

(A)   (B)

7. **The following figures show a flower of a plant and a fungus each of them produces special cells by reproduction process. Answer the following questions :**

a. What are the special cells produced by reproduction process in fig. (A) and (B) ?

b. What is the type of reproduction in each of them ?

c. What is the type of division that occurs to produce the cells in fig. (A) ?

d. What is the relation between the genetic structure of parents and the individuals produced from the reproduction by each of them ?
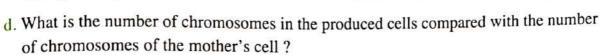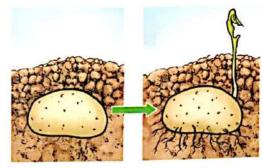
(A)   (B)

8. **The opposite figure shows the stages of asexual reproduction in potato plant. Answer the following questions :**

   a. What is the form of the asexual reproduction in this fig. ?

   b. What is the part of the plant by which the reproduction occurs ?

   c. What is the kind of cell division occurs during this reproduction ?

   d. What is the number of chromosomes in the produced cells compared with the number of chromosomes of the mother's cell ?

9. **Look at the opposite figures, then answer the following questions :** *(Sohag 2018)*

   a. Mention the name of fig. (1) and fig. (2).

   b. At which figure the genetic variation happens ? Why ?
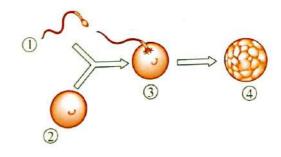
fig. (1)   fig. (2)

10. **The following figure represents one of the important processes to complete the reproduction. Answer the following questions :** *(Behira 2019)*

   a. What is the name of the process that number ③ refers to ? and what is the name of the produced cell ?

   b. What is the kind of division through which number ② is produced, and that occurs to number ④ ?

   c. Write the symbol which represents the number of chromosomes in the cells ① , ② and ③.

11. **Study the opposite figure, then answer the questions :** *(Behira 2017)*

   a. What does this figure represent ?

   b. What is the number of chromosomes in each part in the figure ?

   c. What is the name and the number of chromosomes of the resulted structure ?

   d. Mention the characteristics of the resulted structure.

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Timss Questions

1. Choose the correct answer :

1. The small-sized sperm and large-sized ovum share in the formation of the genetic material and the traits for child by ratio ....
   a. 1 : 2   b. 1 : 1   c. 2 : 1   d. 1 : 4

2. The starfish neither regenerated nor reproduce by regeneration, ...
   a. if you burn the starfish.
   b. if you cut all of its arms, without containing a part of the central disc.
   c. if you cut all of its arms, each one containing a part of the central disc.
   d. (b) & (c) are correct.

3. The bread mould fungus spores will form new identical individuals, when they fall on ....
   a. water surface.   b. a piece of ice.   c. a dry hot bread.   d. a wet bread.

4. The yeast fungus will make the best rate of budding, if it is put in ....
   a. salted warm water.   b. salted boiling water.
   c. sugary cold solution.   d. sugary warm solution.

5. From the plants which can reproduce vegetatively like potato, is ....
   a. apple.   b. orange.   c. sweet potato.   d. tomato.
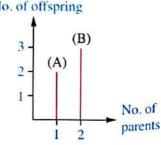
2. Give reasons for :

Both of sexual reproduction and vegetative reproduction are preferred in plants.
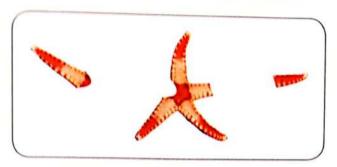
3. What is the type of the reproduction in the following living organism ?

4. The opposite graph represents the relation between the number of parents and number of offspring in two cases of reproduction.

1. What is the type of reproduction in case (A) and (B) ? (Give a reason).

2. What is the relation between the genetic structure of each parents and offspring in the two cases ? (Give a reason).

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5. The following figure represents a starfish, cuted 2 cuts into 3 parts as shown by a knife, how many complete starfish will produced ?

6. After reproduction of the following organisms, in which of them the parent will disappear, and in which of them the parent will not disappear ?

Yeast - Starfish - Hydra - Amoeba - Sponge - Mushroom - Potato - Paramecium - Bread mould fungus - Euglena.

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Project

On UNIT FOUR

A project to develop the mental organization
"Notice of similarties"

* Detect three similarties between each of the following :

1. Interphase of mitosis and interphase of meiosis.

2. Chromosomes in plant cells and chromosomes in animal cells.

3. Sperms and ova.

4. Prophase of mitosis and first prophase of meiosis.

5. Nano-molecules of gold and smart microscopic bombs.

6. Yeast fungus and sponge.

7. Telophase of mitosis and telophase (I) of meiosis.

8. Bacteria and amoeba.

9. Bread mould fungus and mushroom fungus.

10. Anaphase of mitosis and anaphase (II) of meiosis.

Glossary

Unit 1

Lesson 1

curved	منحنى
speed	السرعة
description	وصف
uniform (regular)	منتظم
non-uniform (irregular)	غير منتظم
average speed	السرعة المتوسطة
relative speed	السرعة النسبية
observer	مراقب
magnitude	مقدار / قيمة
relative to	بالنسبة لـ
actual (real) speed	السرعة الفعلية

Lesson 2

graphic representation	تمثيل بياني
physicists	علماء الفيزياء
mathematical relations	علاقات رياضية
wooden board	لوح خشبي
horizontal position	موضع أفقي
intersection point	نقطة تلاقي
origin point	نقطة الأصل
parallel	موازي
acceleration	العجلة
physical quantity	كمية فيزيائية
positive acceleration	عجلة موجبة
negative acceleration	عجلة سالبة
uniform acceleration	عجلة منتظمة

Lesson 3

scalar physical quantities	كميات فيزيائية قياسية
vector physical quantities	كميات فيزيائية متجهة
displacement	إزاحة
actual	حقيقي
numerically	عدديًا / رقميًا
velocity	السرعة المتجهة

Unit 2

Lesson 1

still	ساكنة
light reflection	انعكاس الضوء،
bouncing off	ارتداد
angle of incidence	زاوية سقوط
angle of reflection	زاوية انعكاس
reflecting surface	سطح عاكس
incident light ray	شعاع ضوئي ساقط
reflected light ray	شعاع ضوئي منعكس
protractor	منقلة
upright (erect)	معتدلة
laterally inverted (reversed)	معكوسة جانبيًا
virtual	تقديرية
real	حقيقة
concave	مقعرة
convex	محدبة
converge	يجمع
diverge	يفرق
curvature	التكور
pole of the mirror	قطب المرآة
magnified	مُكبرة
diminished	مُصغرة
land surveyors	مُساح الأراضي
topographical scientists	علماء التخطيط

Lesson 2

transparent	شفافة
battle	موقعة / قتال
optical center	المركز البصري
refract	ينكسر
optic nerve	العصب البصري
vision defects	عيوب الإبصار
short-sight	قصر النظر
long-sight	طول النظر
disperse	يشتت
cataract	مرض إضلام عدسة العين
illness	مرض / داء
genetic readiness	الاستعداد الوراثي
transplanted permenantly	تُزرع على الدوام

Unit 3

The Lesson

English	Arabic
vast	شاسع
distinctive shape	شكل مميز
harmony	تناسق
spiral arms	أزرع حلزونية
spreading straw	التبن المنثور
explosion	انفجار
astronomy	علم الفلك
atomic particles	جسيمات ذرية
merge	تلاحم
perceptions	تصورات
separation (or spacing)	تباعد
raisins	زبيب
ingredients	مكونات
earliest life	الحياة الأولى
nebular theory	نظرية السديم
crossing star theory	نظرية النجم العابر
assumptions	افتراضات

Unit 4

Lesson 1

English	Arabic
cell division	الانقسام الخلوى
somatic cells	خلايا جسدية
reproductive cells	خلايا تناسلية
multicellular	عديدة الخلايا
mitosis (mitotic cell division)	الانقسام الميتوزى
indirect cell division	انقسام غير مباشر
compensation of the damaged cells	تعويض الخلايا التالفة
meiosis (meiotic cell division)	الانقسام الميوزى
reduction division	انقسام اختزالى
gametes	الأمشاج (الخلايا الجنسية)
genetic traits	الصفات الوراثية
offspring	نسل
nuclear acid	حمض نووى
diploid number	عدد ثنائى
haploid number	عدد أحادى
neural cells	الخلايا العصبية
interphase	الطور البينى
duplicate	يتضاعف
prophase	الطور التمهيدى
chromatin reticulum	الشبكة الكروماتينية
strings	خيوط

English	Arabic
spindle fibers	خيوط مغزل
intensifies	تتكثف
metaphase	الطور الاستوائى
anaphase	الطور الانفصالى
shrink	تقلص
telophase	الطور النهائى
adverse changes	تغيرات عكسية
distinct	متماثلة
tetrad	المجموعة الرباعية
crossing over phenomenon	ظاهرة العبور
contributes	تسهم
tweezers	ملقط
thumb	إصبع الإبهام
scalpel	مشرط
tumor	ورم
liver transplantation	زراعة الكبد

Lesson 2

English	Arabic
sexual reproduction	تكاثر جنسى
asexual reproduction	تكاثر لاجنسى
binary fission	انشطار ثنائى
budding	التكاثر بالتبرعم
regeneration	التجدد
spore propagation	التكاثر بالأبواغ (الجراثيم)
vegetative reproduction	التكاثر الخضرى
unicellular protozoans	الأوليات الحيوانية
colony	مستعمرة
sporangia	حافظات جرثومية

SCIENCE

2021

NOTEBOOK

BY A GROUP OF SUPERVISORS

- Worksheets
- Research Projects
- Final Revision
- Final Examinations

EL-MOASSER
SERIES

3rd prep.

CONTENTS

Worksheets

▶ **Worksheets on :**

Unit One   : Force and Motion.
Unit Two   : Light Energy.
Unit Three : The Universe and the Solar System.
Unit Four   : Reproduction and Species Continuity.

Worksheet 1

1. **A. Choose the correct answer :**

1. A moving car covers 500 m in 20 sec., so its speed equals ....

   a. 25 km/h.   b. 20 km/h.   c. 25 m/sec.   d. 20 m/sec.

2. The two factors which are necessary for the description of motion are the ....

   a. weight and length.   b. time and area.

   c. speed and time.   d. distance and time.

3. Speed measuring unit is ....

   a. metre.second.   b. metre/second.

   c. $metre^2$/second.   d. $metre/second^2$.

B. Write the scientific term :

1. The thing which moves with constant speed in the space.   [.........................]

2. The change of object's position as time passes.   [.........................]

2. **A. Complete the following statements :**

1. .... is a physical quantity which is used to describe and compare the motion of objects.

2. Distance = ... × ....

3. A car which travels a distance of 180 km with a regular speed 90 km/h needs .... hours to cover this distance.

4. .... is defined as the covered distance within a unit time.

B. What is meant by ...?

1. A car covers a distance 150 km in 3 hours.

   ....

2. A train moves at a regular speed 70 km/h.

   ....

4

3. The distance covered by a body is changed by 2 m each one second.

....

4. The body moves with a uniform speed.

....

5. The speed of a body equals zero.

....

3. A. Give reasons for :

1. The motion of a train can be considered as a motion in one direction.

....

....

2. The object speed increases by decreasing the time needed to cover a certain distance.

....

....

B. Mention the importance of :

Speedometer in cars and planes.

....

....

4. Problems :

A. A moving object covers a distance 80 metres in 4 seconds then, it covers 120 metres in 6 seconds.

1. Calculate the speed of the object in each period.
2. Mention the kind of speed (giving the reason).

....

....

....

B. Which of the following moves at a higher speed ?

1. A train moves at 72 km/h.
2. A bird covers 20 metres in one second.

....

....

5

Worksheet 2

1. Complete the following statements :

1. The movement of the body is described as regular when its .... speed is equal to its .... speed.

2. The measuring of relative speed depends on the ....

3. Average speed = ... ÷ ....

4. When the relative speed of a moving object is less than its real speed, therefore the observer moves in the .... direction of the moving object.

2. A. What is meant by ...?

1. The average speed of a moving car is 60 km/h.

   ....

2. The relative speed.

   ....

3. The relative speed of a moving object equals zero.

   ....

4. The body moves with irregular speed.

   ....

B. Compare between :

Average speed and irregular speed [according to definition]

Average speed	Irregular speed
....	....
....	....

3. Give reasons for :

1. It is practically difficult to a car to move with a regular speed.

   ....

2. A moving car seems to be at rest relative to an observer in another moving car beside it with the same speed and direction.

   ....

3. The train moves at an irregular speed.

   ....

   ....

4. Problems :

1. A plane moved from Aswan to Cairo in one hour.
   It covers a distance of 1000 km. Calculate the reading of the speedometer by (km/h & m/sec.) if you know that the plane moves with a regular speed.

   ....

   ....

2. Two cars move at the same moment and the same start position, the first car moves at speed of 90 km/h the second one moves at speed of 100 km/h.
   Calculate the difference in time between the arrival of two cars to the end position which faraway the start position by 180 km.

   ....

   ....

3. A body moves by an average speed of 25 m/sec. through 5 sec. then it moves by an average speed of 22 m/sec. through 7 sec. Calculate :
   (a) The total distance covered by the body.
   (b) The average speed from the start motion to its end.

   ....

   ....

4. In cars race recording that values of distance and time which cover by one of racer in four stages as the following table.
   (a) Calculate the average speed of car.
   (b) In which stages the speed of car was :

       1. The maximum.   2. The minimum.

   ....

   ....

Stage	Distance (km)	Time (min)
(1)	14	8
(2)	16	10
(3)	11	20
(4)	16	12
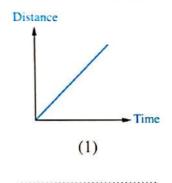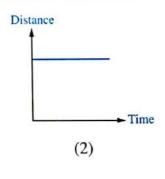
7

Worksheet 3
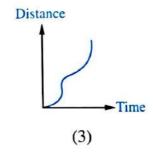
1. **A. Complete the following statements :**

1. The graphical relation (distance-time) for a uniform speed is represented by .... line passing through the point of ....

2. The graphical relation (speed-time) for a uniform speed is represented by a straight line .... to the .... axis.

B. Describe the motion of the body in each of the following graphs :

| (1) | (2) | (3) |

....

2. **A. What is meant by ... ?**
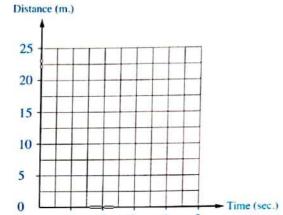
1. The ratio d/t for a moving body is constant.

....

2. The slope of the straight line in graphic relationship (distance-time) for a moving body = 50

....

B. Mention the importance of graphs and tables to physicists :

....

....

....

8

3. The following table represents the distances covered by a moving body through different times intervals :

Distance (d) :	5	10	15	20	25
Time (t) :	1	2	3	4	5
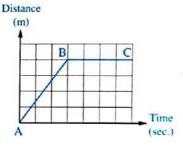
1. Represent the relation graphically.

2. Calculate the speed from the graph.

3. Mention the kind of speed (giving the reason).

....

....

....

....

4. Study the opposite figure, then determine the time interval during which the body :

1. Is at rest : ....

2. Moves at a regular speed : ....

Worksheet 4

1. A. Choose the correct answer :

1. The acceleration (a) equals ....
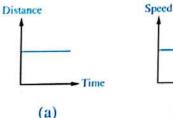
a. $\Delta V - \Delta t$ b. $\Delta V \times \Delta t$ c. $\Delta t / \Delta V$ d. $\Delta V / \Delta t$
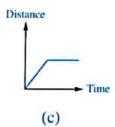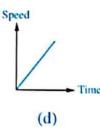
2. Which of the following graphs represents a body moves at zero acceleration ? ....

(a)   (b)   (c)   (d)

3. When an object moves with acceleration = zero, this means that the ....

a. speed is changed.   b. acceleration increases.

c. body moves with deceleration.   d. speed of the body is constant.

B. Give a reason for :

The body which moves with acceleration can't move at a regular speed.

....

....

2. **A. What is meant by ...?**
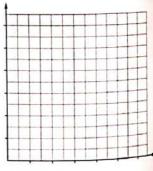
1. A body moves at zero acceleration.

....

2. An object moves with negative acceleration equals $- 5$ m/sec^2.

....

3. The initial speed of a moving body is less than its final speed.

....

B. A car moves with speed 80 m/sec. If the driver used the brakes to decrease the speed so, it decreases by 2 m/sec^2 Calculate its speed after 12 seconds from using the brakes.

....

....

3. **A. Complete the following statements :**
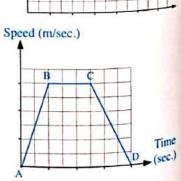
1. The measuring unit of acceleration is ....

2. The motion of an object is described as a decelerating motion when its ....
speed is greater than its .... speed.

3. When the body moves from rest so, its initial speed equals .... and the body
moves with .... acceleration.

B. Define : Acceleration

....

4. **A. Draw a (speed-time) graph for :**

A body moves with regular acceleration 5 m/sec^2.
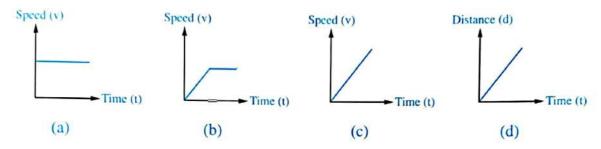
B. The opposite graph represents the motion of a car, which part represents the motion with :

1. Zero acceleration.

2. Negative acceleration.

3. Positive acceleration.

Speed (m/sec.)

10

Worksheet 5 — on Lessons 1 & 2 Unit ONE

1. Choose the correct answer :

1. If the uniform speed of a car is 72 km/h, so its speed in (m/sec.) equals ....

   a. 20 m/sec.   b. 25 m/sec.   c. 18 m/sec.   d. 40 m/sec.

2. Which of the following graphs represents the movement of a body at a uniform acceleration ? ....

   (a)   (b)   (c)   (d)

3. The relative speed of a moving object relative to an observer moves at the same speed in the opposite direction is .... the actual speed.

   a. double   b. the same   c. half   d. quarter

4. It is said that the object moves at a uniform acceleration when ....

   a. its final speed is equal to its primary speed.

   b. its speed increases by equal amounts at equal times.

   c. it covers equal distances at equal times.   d. no correct answer.

5. .... is the change of an object speed in one second.

   a. Speed   b. Acceleration   c. Time   d. Distance

2. A. Put (✓) or (✗), then correct what is wrong :

1. Acceleration is the distance moved through a unit time.

   (   ) ....

2. Relative speed is the speed of a moving object relative to an observer.

   (   ) ....
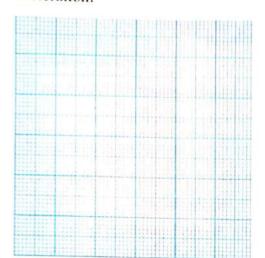
3. Compass helps in identifying the speed of the car directly.

   (   ) ....

11
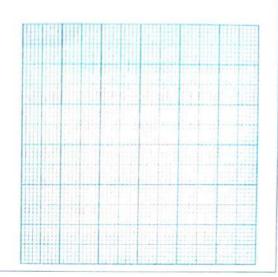
B. What happens when ... ?

1. The initial speed of a moving body is greater than the final speed.

....

2. A body moves at a uniform speed [according to the acceleration].

....

3. A. Complete the following :

1. The distance is measured in ·············· , while acceleration is measured in ··············

2. ·············· is the change of an object position as time passes.

3. When the initial speed of an object is less than its final speed, so it moves at ··············
motion.

B. When do we say that ... ?

1. An object moves at an irregular speed.

....

2. The amount of an object speed is equal to the amount of distance covered.

....

4. A. Compare between :

1. Irregular speed and relative speed :

Irregular speed	Relative speed

2. Positive acceleration and negative acceleration :

Positive acceleration	Negative acceleration

B. Draw a (speed-time) graph for :

1. A body moves with positive uniform acceleration.

2. A body moves with regular speed.

Worksheet 6

1. **A. Choose the correct answer :**

1. Which of the following physical quantities are scalar quantities ? ....

   a. the radius and the area.
   b. the time and the force.
   c. the acceleration and the velocity.
   d. the mass and the displacement.

2. All of the following are vector quantities except the ....

   a. speed.
   b. acceleration.
   c. displacement.
   d. force.

3. All of these are from the examples of the scalar physical quantities except ....

   a. the force and the acceleration.
   b. the time and the mass.
   c. the mass and the speed.
   d. the time and the speed.

4. The shortest distance covered by a body in a certain direction is called the ....

   a. distance.
   b. displacement.
   c. acceleration.
   d. speed.

5. When an object moves in a direct straight line in one direction, therefore ....

   a. distance > displacement.
   b. distance = displacement.
   c. distance < displacement.
   d. displacement = zero.

B. Give reasons for :

1. Speed is a scalar quantity, while velocity is a vector quantity.

   ....
   ....

2. Pilots take in consideration the velocity of wind.

   ....
   ....

2. **A. What is meant by ... ?**

1. Scalar physical quantity.

   ....

2. Amount of displacement.

   ....
   ....

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3. Vector physical quantity.

....

B. Complete the following statements :
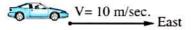
1. .... is the rate of change of displacement, while .... is the rate of change of distance.

2. Average velocity = ... ÷ ....

3. Physical quantities are classified into .... and ....

3. Compare between : (Distance and displacement)

Points of comparison	Distance (d)	Displacement $\vec{d}$
- Definition :		
- It is determined by :		
- Its kind :		
- Measuring unit :		

4. (1) From the opposite figure :

Calculate the displacement of the car after time equals :

$V = 10$ m/sec. East
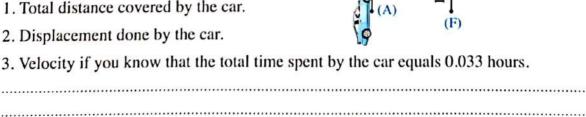
(a) 2 seconds. (b) 5 seconds.

....

....

(2) A hand-ball field in the form of a rectangle of 60 metres length and 40 metres width. What is the amount of distance and displacement covered by a player moves around the field one complete cycle ?

....

....

(3) In the opposite figure, a car starts motion from point (A) to point (F) passing by points (B), (C), (D) and (E). Calculate :

(B) 5 km (C)
2 km
(E) 3 km
1 km
(A) 1 km (D)
(F)

1. Total distance covered by the car.

2. Displacement done by the car.

3. Velocity if you know that the total time spent by the car equals 0.033 hours.

....

....

....

15
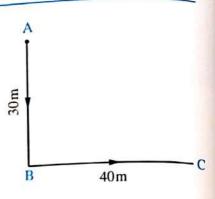
(4) In the shown figure, a body began its movement from point (A) to the south till point (B) covering a distance of 30 m through 3 seconds, then to the east till point (C) which is 40 m far from point (B) through 4 seconds. Calculate :

1. Distance covered by the body.
2. Average speed by which the body is moving.

....
....

(5) From point (A), a body covered 20 metres northward within 10 seconds, then 40 metres eastward within 20 seconds, and then 20 metres southward within 10 seconds as shown in the figure. Calculate :

1. The value of the total distance that the body covered.
2. Total time.
3. Average velocity.
4. What does the straight line between point (A) and point (D) represent ?

....
....
....
....

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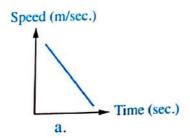
1. Choose the right answer :
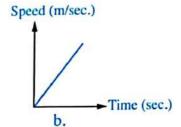
1. Speed measuring unit is ....
   a. metre. second.   b. metre/second.   c. metre/second^2.

2. Acceleration measuring unit is ....
   a. metre/second.   b. metre. second.   c. metre/second^2.

3. Displacement is a vector quantity and its unit is ....
   a. metre.   b. metre/second.   c. metre/second^2.
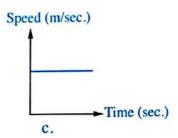
4. The amount of the change in the speed of a moving object in one second equals ....
   a. velocity.   b. displacement.   c. acceleration.

5. The object moves at a constant uniform speed when ....
   a. it moves at zero acceleration.
   b. it moves at constant acceleration.
   c. it covers equal distances at unequal times.

6. It is said that the object moves at a uniform acceleration when ....
   a. its final speed is equal to its primary speed.
   b. its speed increases by equal amounts at equal times.
   c. it covers equal distances at equal times.

7. Acceleration is ....
   a. a vector quantity whose unit is m/sec^2.
   b. a vector quantity whose unit is m/sec.
   c. a scalar quantity whose unit is m/sec^2.

8. The amount of change in speed at a time unit determines ....
   a. velocity.   b. displacement.   c. acceleration.

9. Which of the following graphs (speed-time) describes the movement of an object at a constant speed ....

Speed (m/sec.) — Time (sec.) a.

Speed (m/sec.) — Time (sec.) b.

Speed (m/sec.) — Time (sec.) c.

10. A car moving on a straight line covers a total distance (d) in a total time (t), the average speed of the car is given by ....

a. $\overline{V} = \dfrac{d}{t}$ b. $\overline{V} = dt$ c. $\overline{V} = \dfrac{t}{d}$

2. If an object moves from rest regularly until its speed reaches 10 m/sec. after two seconds from the start of movement, so :

1. The change in the object's speed through two seconds = ... m/sec.
2. Acceleration = ... m/sec².

3. Problems :

1. A special car can move from rest and its speed reaches 25 m/sec. in 10 seconds. What is the acceleration with which the car moved ?

   ....

   ....

2. Within 2.5 seconds, the speed of a car increases from 20 m/sec. to 25 m/sec., while a bike moves from rest and its speed reaches 5 m/sec. in one second. Which of them moved at a greater acceleration ?

   ....

   ....

4. Complete the missing parts in the table :

Speed (metre/sec.)	Distance (metre)	Time (second)
.... (1)	100	5
5	.... (2)	10
8	96	.... (3) ....

Model Exams on Unit 1

Model Exam 1

20

Answer the following questions :

Question 1 5 marks

A Complete the following :

1. .... is the rate of change of distance, while .... is the rate of change of displacement.

2. The two factors necessary for the description of motion are the .... covered by the moving body and the .... needed to cover this distance.

3. Speed measuring unit is .... and acceleration measuring unit is ....

B Compare between :

Distance and displacement (according to : Definition – Kind as a physical quantity).

P.O.C.	Distance	Displacement
Definition :		
Kind :		
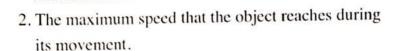
Question 2 5 marks

A What is meant by ... ?
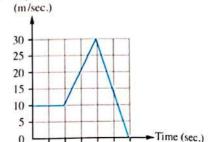
1. The average speed of a moving car is 50 km/h.

....

2. An object covers 40 m northward direction in 20 sec.

....

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B The opposite graph represents the movement of an object. Calculate :

1. The distance that the object covered in the first four seconds.

....

2. The maximum speed that the object reaches during its movement.

....

3. The amount of acceleration that the object moves in the last four seconds. Mention its kind.

....

Speed (m/sec.) graph with values 30, 25, 20, 15, 10, 5, 0 on vertical axis and 2, 4, 6, 8, 10, 12 Time (sec.) on horizontal axis.

Question 3 — 5 marks

A Write the scientific term :

1. The value of an object speed determined in relation to an observer. [·············]
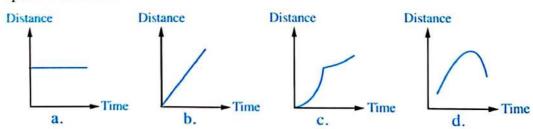
2. The change of the object speed by equal values through equal periods of time. [·············]

B Draw a (speed–time) graph which represents :

1. An object moves at a regular speed.	2. An object moves at a uniform negative acceleration.

C Choose the correct answer :

1. Which of the following graphs represents the movement of an object at a constant speed ? ....

Distance / Time graphs labeled a., b., c., d.

2. Movement is at a uniform acceleration ....

    a. if the object's speed changes at equal values in equal time intervals.

    b. if the distance that the object covers changes at equal values in equal time intervals.

    c. if the average speed equals the regular speed.

    d. no correct answer.
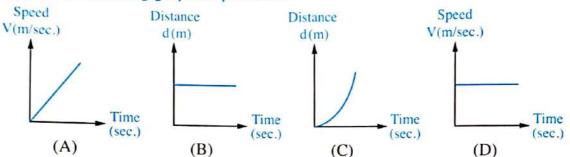
3. When car (A) covers smaller distance than car (B) at the same time span, therefore ....

    a. car (A) is faster than car (B).   b. car (B) is faster than car (A).

    c. the two cars move at the same speed.   d. there is no correct answer.

4. If the value of the speed $= \dfrac{d_1 + d_2 + d_3}{t_1 + t_2 + t_3}$, this means that this speed is .... speed.

    a. average   b. nil   c. increasing   d. decreasing

5. When an object moves in a straight line in one direction, the ratio between the distance that the object moved and the displacement is ....

    a. more than one.   b. less than one.

    c. equal to one.   d. equal to zero.

Question **4** 5 marks

A Two cars move on a slope, the first car moves upward the slope by initial speed of 20 m/sec. and by an acceleration of – 2 m/sec², while the second car moves downward the same slope by initial speed of 5 m/sec. and by an acceleration of 5 m/sec².
If the two cars meet after 6 sec. Calculate the relative speed of the first car according to the driver in the second car.

....

....

B Put (✓) or (✗) , then correct what is wrong :

1. A car moves at a regular speed equals 30 m/sec. , this means that it covers 60 metres within two seconds.

    (   ) ....

2. Decelerating motion means that the object speed increases by time.

    (   ) ....

3. The force is from the scalar physical quantities.

    (   ) ....

Model Exam **2**   20

Answer the following questions :

Question **1** 5 marks

A Write the scientific term :

1. The distance covered in a certain direction between the starting point and the ending point.

                  [...................]

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2. The change of an object position as time passes according to the position of another object.

[···············]

3. The amount of change in the object's speed in a second.

[···············]

B If a car takes 4 hours on its journey and its speed at the first hour is 100 km/h and at the second and third hours is 80 km/h and in the fourth hour is 40 km/h. Calculate the average speed for this car.

···

···

C Which of the following graphs represents :

Speed V(m/sec.)	Distance d(m)	Distance d(m)	Speed V(m/sec.)
(A)	(B)	(C)	(D)
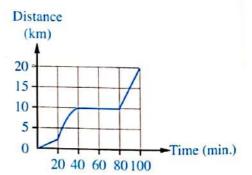
1. An object moves at a uniform speed : ··

2. An object moves at a uniform acceleration : ···

3. An object moves at an irregular speed : ···

4. An object is at rest : ··

Question 2   5 marks

A Choose the correct answer :

1. The opposite graph represents the movement of a bicycle that got a hole in one of its tires and it took ··············· minutes to be repaired.

   a. 20   b. 30

   c. 40   d. 70

2. If the relative speed of a car is 60 km/h relative to an observer in another car moves in the same direction at 40 km/h , therefore the actual speed of this car is ···············

   a. 20 km/h.   b. 60 km/h.   c. 100 km/h.   d. 120 km/h.

3. A car moves at speed 20 m/sec., then its speed changes to 30 m/sec. within 5 seconds, therefore the acceleration by which the car moves equals ···············

   a. 2 m/sec.   b. 2 m/sec^2.   c. 5 m/sec.   d. 5 m/sec^2.

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4. .... are examples of vector quantities.

   a. Velocity and speed   b. Energy and force

   c. Displacement and velocity   d. Distance and weight

5. If an object moves in a circular path, so the amount of displacement when it covers $\frac{1}{4}$ circle, is equal to its amount of displacement when it covers .... circle.

   a. $\frac{1}{3}$ b. $\frac{1}{2}$ c. $\frac{3}{4}$ d. 1

B Give reasons for :

1. The car (A) which covers 60 metres in 6 seconds is faster than car (B) which covers 64 metres in 8 seconds.

   ....

2. The object which moves at a uniform speed, its acceleration equals zero.

   ....

Question **3** *5 marks*

A Complete the following statements :

1. The result of multiplying speed of a moving object by time equals ....

2. Vector physical quantity is the quantity that has .... and ....

3. The measuring unit of displacement is .... , while the measuring unit of mass is ....

4. Average velocity = $\dfrac{\text{...........}}{\text{...........}}$

B Compare between :

Speed and velocity (according to : Definition – Kind as a physical quantity – Measuring unit).

P.O.C.	Speed	Velocity
Definition :		
Kind :		
Measuring unit :		

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Question 4   5 marks

A The distance covered by a moving object through different times are recorded in the following table.

The distance (m)	10	20	30	40	50	60
The time (second)	5	10	15	20	25	30

1. Represent the relatoin graphically.
2. Calculate the object speed.

....

....
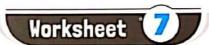
B What is meant by ... ?

1. An object moves a distance 60 m and the amount of displacement equals zero.

....

2. Positive acceleration.

....

....

C A moving object, its initial speed equals 7.5 m/sec. and the acceleration equals 10 m/sec^2 Calculate the time at which the final speed becomes 4 times its initial speed.

....

....

Worksheet 7

1. Complete the following statements :

1. The reflecting surface of the convex mirror is a part of .... surface of the sphere.

2. The radius of curvature of the convex mirror equals .... its focal length.

3. From types of mirrors are .... and ....

4. The image formed by a plane mirror for an object is .... , reversed, ... and equals to the object in size.

5. The focus of the concave mirror is the point of collection of the .... rays after being .... from the mirror.

6. .... mirror diverges light rays, while .... mirror converges light rays.

2. A. Explain by an experiment the two laws of light reflection :

....

....

....

....

....

B. Choose the correct answer :

1. The rebounding of the light ray in the same medium when it meets a reflecting surface is known as the ....

a. incident light ray.

b. reflected light ray.

c. light reflection phenomenon.

d. light refraction phenomenon.

2. The straight line passing by the pole of the mirror and its centre of curvature represents ....

a. the pole of the mirror.

b. the secondary axis of the mirror.

c. the principal axis of the mirror.

d. there is no correct answer.

3. A spherical mirror whose radius of curvature equals 40 cm., its focal length equals ....

a. 10 cm.

b. 20 cm.

c. 40 cm.

d. 80 cm.

4. If a body is put in front of a plane mirror as shown in the opposite figure :

Body
←— 4 cm. —→

(A) The distance between the image and the mirror surface is ....

a. 2 cm.

b. 3 cm.

c. 1 cm

d. 4 cm.

(B) If the mirror moves a distance of 1 cm in the direction of the body so, the distance of the image from the first image is ....

a. 1 cm.

b. 2 cm.

c. 3 cm

d. 4 cm.

3. A. Give reasons for :

1. The word AMBULANCE is written in a converted way on the ambulance car.

....

....

2. The perpendicular incident light ray on a plane mirror reflects on itself.

....

B. Put (✓) or (✗) in front of the following statements and correct the wrong ones :

1. Focal length of the mirror = 2 × radius of mirror curvature.

(   ) ....

2. The straight line joining the object to its image is parallel to the surface of the plane mirror.

(   ) ....

3. Angle of incidence is the angle between the incident light ray and the normal.

( ) ....

4. The centre of mirror curvature lies behind the reflecting surface in the concave mirror.

( ) ....

4. A. Write the scientific term :

1. The point at which the rays, which incident parallel to each other and parallel to the principal axis of the concave mirror, are collected.   [.........................]

2. The incident light ray, the reflected light ray and the normal line to the surface of reflection at the point of incidence all lie in one plane perpendicular to the reflecting surface.   [.........................]

B. Define : The first law of light reflection.

....

C. If the angle between the reflected light ray and the reflecting surface = 40°. Find the angle of incidence.

....

Worksheet 8

1. A. Show by drawing the path of rays which form an image in the following cases :

1. An object is put in front of a concave mirror at a distance equals the double of the focal length.

2. An object is put in front of a concave mirror at a distance less than the focal length.

(1)   (2)

B. What is meant by ... ?

1. Virtual image : ....

2. Real image : ....

2. A. Compare between :

Convex mirror and concave mirror.

[Concerning : The position of the centre of curvature - Way to form virtual image].

Points of comparison	Convex mirror	Concave mirror
- The position of the centre of curvature :	....	....
- Way to form virtual image :	....	....

B. Choose the correct answer :

1. When an object is put in front of a concave mirror at the centre of mirror curvature, the properties of the formed image are ....

   a. real, inverted and small.   b. real, inverted and equals to the object.

   c. real, inverted and magnified.   d. virtual, erect and magnified.

2. If the position of the formed image of an object at a distance greater than the radius of curvature of a concave mirror, so the position of the object is ....

   a. at the centre of curvature.   b. at a distance less than the focal length.

   c. between the focus and the centre of curvature.

   d. very far.

3. If a light ray falls parallel to the principal axis on a concave mirror, it reflects ....

   a. passing through the centre of curvature of the mirror.

   b. passing through the focus.   c. on itself.

   d. there is no correct answer.

4. If the focal length of a concave mirror equals 10 cm, to obtain a virtual image, the body is placed at a distance from the mirror pole equals ....

   a. 10 cm   b. 15 cm.   c. 20 cm.   d. 5 cm.

3. **A. Mention three uses only for :**

1. Concave mirror :

....

....

2. Convex mirror :

....

....

B. Complete the following figures by drawing the path of the reflected light rays :
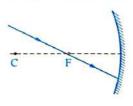
Fig. (1)   Fig. (2)   Fig. (3)
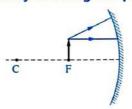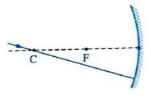
4. **A. Complete the following statements :**

1. A convex mirror has a focal length of 20 cm, then the radius of curvature of its spherical surface equals ....

2. When a body lies in front of a concave mirror at a distance .... of its focal length, a real, smaller and .... image is formed.

3. A virtual, erect and enlarged image can be formed by .... mirror.

B. Give reasons for :

1. Concave mirror is used to generate high heat energy.

....

2. A convex mirror is put at the left side of the driver of the car.

....

3. The image formed by a convex mirror is always virtual.

....

C. Mention the properties of the image formed by the convex mirror.

....

....

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Worksheet 9

1. Complete the following statements :

1. The lens is a .... medium that .... the light and is limited with two spherical surfaces.

2. There are two types of lenses which are .... and ....

3. The incident light ray that passes through the .... of the convex lens, it exits from the lens parallel to the ....

4. If an object is put in front of a convex lens at a distance greater than the double of the focal length, so the image is formed between the .... and the ....

5. The convex lens .... light rays, while the convex mirror .... light rays.

6. The incident light ray that is parallel to the principal axis of the convex lens, it penetrates the lens passing through ....

2. A. Draw a diagram to illustrate the image formed when the object is placed at a distance more than the double of the focal length in case of :

1. The concave mirror.

2. The convex lens.

(1)

(2)

B. Give reasons for :

1. The concave lens is called diverging lens.

....

2. No image is formed for the object that is located at the focus of convex lens.

....

30

3. Lenses have two centres of curvature.

....

3. **A. A body of length 4 cm is placed at a distance of 6 cm from a convex lens, its focal length is 3 cm.**

1. Draw a diagram to show the path of the rays falling on the lens and the refracted ones from it.

2. Mention the properties of the formed image.

....

3. Mention the length of the image and the radius of the lens.

....

B. What is meant by ... ?

1. The principal axis of a lens.

....

2. The focal length of a convex lens is 5 cm.

....

3. The centre of curvature of the lens face.

....

4. **A. Choose the correct answer :**

1. If the radius of curvature of a lens equals 20 cm., so its focal length equals ....

   a. 5 m.   b. 10 cm.   c. 20 cm.   d. 10 m.

2. A convex lens is placed in the passage of sun rays, a very small real image for the Sun is formed at a distance of 20 cm. from the optical centre of the lens, if this lens is used to form virtual, upright and enlarged image for another body. Which of the following distances of the object from the optical centre is correct ? ....

   a. 10 cm.   b. 20 cm.   c. 40 cm.   d. 50 cm.

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3. Lenses are used in ....

   a. cameras.

   b. medical glasses.

   c. binoculars.

   d. all the previous things.

4. The optical piece that forms a real image and equals to the object is the ....

   a. convex mirror.   b. plane mirror.   c. convex lens.   d. concave lens.

5. The properties of the formed image of a body placed at a distance less than the double of focal length, but more than the focal length of the convex lens are ....

   a. virtual and enlarged image.

   b. real and enlarged image.

   c. real and diminished image.

   d. no correct answer.

6. If the focal length of a concave lens is 6 cm, so the radius of curvature is ....

   a. 3 cm.   b. 6 cm.   c. 9 cm.   d. 12 cm.

B. Explain an activity to determine the focus of the convex lens :

....

....

....

....

....

Worksheet 10

1. A. Compare between : Long-sightedness and short-sightedness.

[Concerning : Definition - The position of the formed image - Treatment]

Points of comparison	Long-sightedness	Short-sightedness
- Definition :	....	....
- The position of the formed image :	....	....
- Treatment :	....	....

B. Mention the most important uses of lenses.

....

....

....

2. A. Put (✓) or (✗) :

1. Eye lens is a concave lens. ( )

2. The image formed by the concave lens is always virtual. ( )

3. Contact lenses stick to the eye cornea by the eye fluid. ( )

4. Illness and old age are from the reasons of the cataract disease. ( )

B. Choose the correct answer :

1. Virtual image is formed by ....

    a. plane mirror.   b. concave lens.

    c. convex mirror.   d. all the previous answers.

2. The normal person sees the near objects at a distance ....

    a. not less than 25 cm.   b. less than 25 cm.

    c. more than 6 cm.   d. no correct answer.

3. The erect images in the mirrors and lenses are .... images.

    a. virtual   b. real   c. real or virtual   d. no correct answer

4. The reasons of long-sightedness are ....

    a. the decrease of eyeball diameter.

    b. the decrease of convexity of eye surface.

    c. the increase of eyeball diameter.

    d. (a) and (b) are correct.

3. A. Give reasons for :

1. It is impossible to obtain a real image by using a concave lens.

....

2. The contact lenses are called by this name.

....

3. Some persons have short-sightedness.

....

B. Write the scientific term :
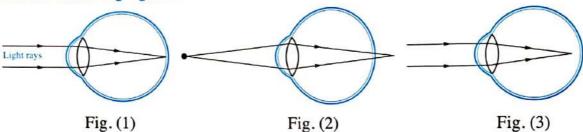
1. A disease infects the eye lens, so it becomes dark.   [.....................]

2. The material from which the contact lenses are made.   [.....................]

4. From the following figures :

Light rays

Fig. (1)   Fig. (2)   Fig. (3)

1. Which figure represents a normal eye ? Why ?

....

....

2. In the previous figures, which case can be treated by a convex lens ? Why ?

....

....
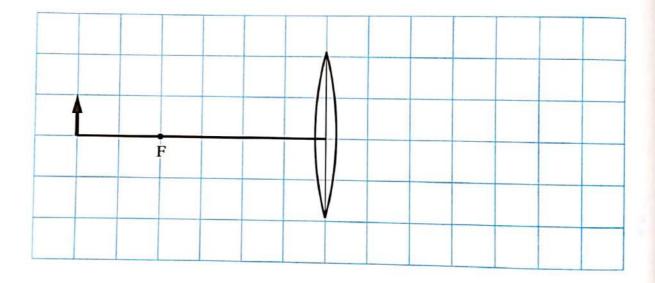
1. Choose the correct answer from the given choices :

1. If a light ray falls parallel to the principal axis of a concave mirror it reflects ....

   a. passing by the spherical centre of curvature of the mirror.

   b. passing by the focus.　　　　　　　　　　c. on itself.

2. An object is placed at the focus of a convex lens, the image will ....

   a. be formed between the focus and the centre of curvature.

   b. be formed at the centre of curvature.　　　c. not formed.

3. A concave mirror has a focal vertex of 10 cm, so the radius of curvature of its surface equals ....

   a. 5 cm.　　　　　　　b. 10 cm.　　　　　　　c. 20 cm.

4. A convex lens has a focal length of 50 cm. An object is placed at a distance 80 cm. from the lens. The image of the object is formed at a distance ....

   a. greater than 100 cm.　　b. equals 100 cm.　　c. equals 50 cm.

5. The image formed by using a concave lens is ....

   a. real, enlarged, and inverted.　　　　b. virtual, smaller and inverted.

   c. virtual, smaller and upright.

2. Complete the following :

1. The point that is in the middle of the reflecting surface of the concave mirror is called ....

2. The straight line that passes by the pole of the mirror and its centre of curvature is ....

3. The distance between the focus of the concave mirror and its pole is called ....

4. A convex mirror has a focal length of 20 cm, then the radius of curvature of its spherical surface equals ....

5. A long-sighted person needs a medical eye glasses with a .... lens.

3. Explain the following :

1. The focal length of the thick convex lens is less than that of the thin convex lens.

....

....

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2. The concave lens is used to treat a short-sighted person.

....

3. The long-sightedness is treated by using a convex lens.

....

4. The object that is placed at the focus of a convex lens does not form an image.

....

5. The collective lens has two foci, while the collective mirror has one focus.

....

4. A convex lens has a focal length equals 4 cm. An object is placed at a distance of 6 cm from the lens. Determine the position of the formed image and its properties by drawing two light rays only.

Model Exams on Unit 2

Model Exam 1

20

Answer the following questions :

Question 1 5 marks
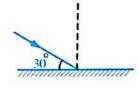
A) Choose the correct answer :

1. Short-sightedness is corrected by the ....

   a. convex lens.   b. concave lens.   c. convex mirror.   d. concave mirror.

2. A light ray that falls on a plane mirror as in the figure, it reflects, where the angle of reflection equals ....

   a. 30°   b. 60°
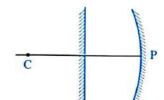
   c. 90°   d. 120°

3. If a light ray falls perpendicular on a flat reflecting surface, the angle of incidence equals ....

   a. zero.   b. 60°   c. 90°   d. 180°

4. If you put a plane mirror in the mid-distance between (C)&(P) of a concav mirror, as shown in the figure, so ....

   a. no images are formed at all.

   b. each mirror will form an image for the other one.

   c. the concave mirror will form an image for the plane mirror.

   d. the plane mirror will form an image for the concave mirror.

B) Mention the reasons of short-sightedness.

....

C) What is meant by ... ?
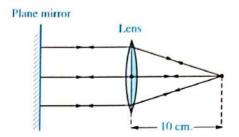
1. The virtual focus of the concave lens.

....

2. Angle of reflection.

....

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Question 2 5 marks

A Give reasons for :

1. The spherical mirror has only one principal axis and uncountable number of secondary axes.

   ....

2. The incident light ray falling perpendicular on a reflecting surface, reflects on itself.

   ....

3. The mirror has one focus, while the lens has two foci.

   ....

B Put (✓) or (✗) :

1. All of the images that are formed by the plane mirror are real.   ( )
2. The spherical mirror of diameter 12 cm, its focus lies at a distance of 3 cm, from its pole.   ( )
3. Concave lens and concave mirror are convergent.   ( )
4. If you paint the two spherical surfaces of a convex lens, with a thin layer of silver metal, then it can't be used neither as a lens nor as a mirror.   ( )

Question 3 5 marks

A Write the scientific term :

1. The straight line joining the two centres of curvature of a lens passing through the optical centre of the lens.   [·············]
2. An optical piece that can be used on the corners of narrow roads to monitor cars movement.   [·············]
3. The phenomenon of the bouncing off a light ray on the mirror's surface.   [·············]
4. The point that is in the middle of the reflecting surface of the mirror.   [·············]

B Show by drawing the properties of the reflected rays, when an object put at the mid-distance of radius of curvature of a concave mirror.

Question **4** *5 marks*

A From the opposite figure, answer the following :
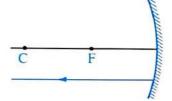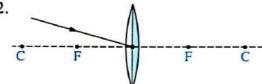
1. What is the type of the lens ? ....

2. The focal length of the lens = ...

3. The distance between the centre of curvature and the optical centre of the lens is called .... and it equals ....

Plane mirror

Lens

10 cm.
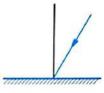
B Mention the three types of mirrors.

....

C Complete the following figures :

1.

C   F

2.

C   F   F   C

3.

4.

F   C

Model Exam **2** 20

Answer the following questions :
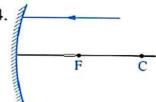
Question **1** *5 marks*

Complete the following statements :

1. The types of lenses are .... and ....

2. The properties of the image formed by the convex mirror are .... , ... and virtual.

3. The vision defect which is due to a shortness in the radius of the eye sphere is called ....

4. The radius of the curvature of the lens is the distance between .... and ....

5. The concave lens .... the light rays falls on it.

6. When the object lies in front of .... lens, a virtual and diminished image is formed.

7. In solar ovens, ... mirrors are used.

Question 2 5 marks

A A convex mirror, its focal length is 6 cm. Calculate its radius of curvature.

....

B Compare between : .

1.

Real image	Virtual image
....	....
....	....
....	....
....	....

2.

Short-sightedness	Long-sightedness
....	....
....	....
....	....
....	....
....	....

Question 3 5 marks

A The opposite figure represents a vision defect :

1. What is the type of defect in this eye ?

....

2. How does this eye see the near objects and far objects ?

....

3. What is the type of the lens used to correct this defect ?

....

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B What are the properties of the image formed by a plane mirror ? (Four only)

....

....

Question **4** *5 marks*

A Mention the position and the properties of the image formed for an object is put at a distance larger than the twice of the focal length of a convex lens.

....

....

B Correct the underlined words :

1. **Moving** water can act as a mirror.　　　　　　　　　　[..............]

2. Sun rays are **diverging** rays.　　　　　　　　　　　　[..............]

3. The light ray that is incident on the convex lens and passing through the focus,

   it exits from the lens **without refraction**.　　　　　　[..............]

4. In the dental clinic, the doctor uses a **concave lens** to see the molars teeth magnified.

   　　　　　　　　　　　　　　　　　　　　　　　　　[..............]

C Choose the correct answer :

1. All of the following light rays, can reflect on itself except ....

   a. The light ray passes on the principal axis, then fall on a concave mirror.

   b. The light ray passes on the secondary axis, then fall on a convex mirror.

   c. The light ray passes on the normal, then fall on a plane mirror.

   d. The light ray that falls perpendicular on a clear water basin.

2. Which one of the following white light rays, neither reflected nor refracted ? ....

   a. When they fall on a shiny surface of aluminium foil sheet, then on rough surface.

   b. When they pass from air to water.

   c. When they form seven spectrum colours through a transparent glass prism .

   d. When they travel from the Sun till they reach the atmospheric envelope of the Earth.

Worksheet 11

1. **A. Write the scientific term for each of the following :**

1. The wide and extended space that contains all the galaxies, stars, planets and everything. [.........................]

2. Groups of galaxies that rotate in the cosmic space. [.........................]

3. The Sun and eight planets revolving around it. [.........................]

4. A theory explains the origin of the universe due to a massive explosion followed by continuous expansion and changing processes since 15000 million years. [.........................]

B. Study the opposite figure, then answer :

1. What's the galaxy which our solar system belongs to ?

   ....

2. What does point (X) refer to ?

   ....

C. What will happen if there is no attraction force between the Sun and the Earth ?

....

....

2. **A. Complete the following statements :**

1. Stars rotate around the centre of the .... , while planets rotate around the ....

2. The distances between stars are measured in .... unit and it equals .... km.

3. As the distance between the planet and the Sun increases, the Sun gravity .... and its motion becomes ....

4. After .... million years from the Big Bang, our galaxy took its disc form, while the Sun was born after .... million years from the Big Bang.

5. The universe originated from a gaseous ball of .... pressure and .... volume.

6. In Milky Way galaxy, the old stars gather in the .... of the galaxy, while small stars are located in the .... arms of the galaxy.

B. Define each of the following :

1. The galaxy.

   ....

2. The expansion of the universe.

   ....

C. Correct the underlined words :

1. Within minutes of the explosion of Big Bang, the percentage of **helium** gas was 75%

   [.........................]

2. Galaxies began to form after **5000** million years from Big Bang.   [.........................]

3. Each galaxy has a distinctive shape according to the harmony and order of the groups

   of **planets** in it.   [.........................]

3. A. Choose the correct answer :

1. The biggest star that can be seen clearly by people on the Earth is ....

   a. Saturn.   b. the Sun.   c. Uranus.   d. Neptune.

2. The Sun takes about .... million years to complete one rotation around

   the centre of the galaxy.

   a. 15000   b. 220   c. 50   d. 22

3. The volume of the universe .... up till now.

   a. is constant   b. contracts   c. expands   d. contracts and expands

4. Earliest life forms began to appear on the Earth after .... years from the Big Bang.

   a. 3000 million   b. 12000 million   c. 15000 million   d. 17000 million

5. The gases which produced galaxies, stars and universe are ....

   a. oxygen and helium.   b. oxygen and carbon dioxide.

   c. hydrogen and helium.   d. hydrogen and carbon dioxide.

6. The theory which explains how the universe originated is .... theory.

   a. Crossing star   b. Nebular   c. Solar system   d. Big Bang

B. Give reasons for :

1. Our galaxy is called by the Milky Way.

   ....

   ....

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2. The continuous expansion of the cosmic space.

....

....

3. The stability of the Earth rotation in an orbit around the Sun.

....

C. When each of the following events happened ... ?

1. Big Bang : ....

2. Ancestral galaxies formed : ....

3. The Earth and planets were created : ....

....

4. A. Compare between : Universe and galaxy.

Universe	Galaxy
....	....
....	....
....	....
....	....

B. Put (✓) or (✗) in front of the following statements :

1. The universe contains various galaxies that move away from each other.   (   )

2. The Milky Way galaxy has straight arms.   (   )

C. Write a paragraph about solar system.

....

....

....

Worksheet 12

1. A. Complete the following statements :

1. The founder of nebular theory about the evolution of the solar system is ....

2. Over the time, the nebula lost its heat gradually so, its volume .... and its revolving speed around itself ....

3. The theory that assumed that the solar system was a glowing gaseous sphere is ....

4. The explosion of the expanded part from the Sun towards the crossing star led to formation of .... line of a great length and the .... escaped from the gravity of the crossing star.

5. The solar system was originally .... according to the crossing star theory, while according to modern theory, it was originally ....

6. .... is from telescopes that are centered on the Earth, while .... is from telescopes that are carried into space.

B. Choose from columns (B) & (C) what suits in column (A) :

(A) Theory	(B) The founder	(C) The origin of the solar system
1. Crossing star	a. Newton	A. A glowing gaseous sphere.
2. Nebular	b. Fred Hoyle	B. A star rather than the Sun.
3. Modern	c. Laplace	C. The Sun.
	d. Chamberlain and Moulton	D. The solar nebula.

1. .... , ... 2. .... , ... 3. .... , ...

2. A. Mention the assumptions of the crossing star theory.

....

....

....

....

B. Give reasons for :

1. The nebula lost its sphere form and became in a form of a flat rotating disk.

....

2. Explosion of some stars suddenly.

....

....

3. A. Mention two observations affect the perception of Laplace about the evolution of the solar system.

....

....

B. What are the results based on ... ?

1. The explosion of the star nearer to the Sun according to Fred Hoyle.

....

2. Approaching of a huge star to the Sun according to the crossing star theory.

....

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1. Put (✓) or (×) in front of the following sentences and correct the false ones :

1. The solar system is located at the edge of the Milky Way galaxy.

   ( ) ....

2. Each group of stars is gathered in the solar system.

   ( ) ....

3. The universe contains various galaxies that move away from each other.

   ( ) ....

4. Eight planets including the Earth rotate around the galaxy.

   ( ) ....

5. Galaxies rotate in a system around the centre of the universe.

   ( ) ....

6. Galaxies move away from each other in the cosmic space.

   ( ) ....

2. Give reason for each of the following :

1. The continuous expansion of the cosmic space.

   ....

2. Galaxies move away from each other.

   ....

3. Write a paragraph illustrates each of the following :

1. The crossing star theory.

   ....

   ....

2. The nebula.

   ....

   ....

3. The cosmic space.

   ....

   ....

4. The galaxy.

   ....

   ....

5. The solar system.

   ....

   ....

Model Exam 20

Answer the following questions :

Question 1 5 marks

A What is meant by ... ?
1. Nebula.

....

2. Light year.

....

3. The Big Bang.

....

4. Galaxies.

....

B Complete the following statements :
1. The stars move in fixed orbits around the centre of the ....
2. .... are groups of galaxies that rotate together in cosmic space with the effect of gravity.
3. After 5000 million years from the Big Bang, the Milky Way galaxy took its .... form.

Question 2 5 marks

A Write the scientific term :
1. The wide and extended space that contains galaxies. [.........................]
2. The force that keeps the continuity of the planets rotation in their orbits around the Sun. [.........................]
3. It is located in one of the spiral arms of the Milky Way galaxy. [.........................]
4. The biggest star that can be seen clearly by people on the Earth. [.........................]

B Give reasons for :
1. Galaxies move away from each other.

....

2. Planets revolve around the Sun in fixed orbits.

....

3. Astronomers don't measure the distances between stars in kilometres.

....

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Question 3 — 5 marks

A Correct the underlined words :

1. The universe emerged from the particles of **oxygen** and **nitrogen**.   [......................]
2. The solar system was a flaming **solid mass** revolving around itself.   [......................]

B Write a short paragraph illustrates each of the following :

1. The modern theory.

....
....
....

2. The nebular theory.

....
....
....

Question 4 — 5 marks

A Look at the following figures, which illustrate the stages of the origin of the universe since Big Bang. Arrange them then mention what is each figure indicate ?

Fig. (1)

....
....

Fig. (2)

....
....

Fig. (3)

....
....

Fig. (4)

....
....

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B Choose the correct answer :

1. .... is the star of our solar system.

   a. Moon   b. The Sun   c. Galaxy   d. The Earth

2. The nebular theory about the evolution of the solar system was found by ....

   a. Newton.   b. Laplace.   c. Moulton.   d. Chamberlain.

3. The Sun takes about .... million years to complete one rotation around the centre of the galaxy.

   a. 320   b. 220   c. 203   d. 302

4. Within minutes of Big Bang, helium gas was formed by a percentage of ....

   a. 25%   b. 50%   c. 75%   d. 100%

5. The solar system consists of .... planets.

   a. seven   b. eight   c. nine   d. ten

6. .... theory assumed that the origin of the solar system was from the explosion of the expanded part of the Sun of forming a gaseous line of a great length from the Sun due to a huge star approached to it.

   a. Nebular   b. Big Bang   c. Crossing star   d. Modern

Worksheet 13

1. Write the scientific term :

1. The point of connection of the two chromatids together.   [.......................]

2. It consists of two chromatids connected together at centromere.   [.......................]

3. The phase in which the cell prepares itself to divide by duplicating the genetic material.

[.......................]

4. The phase in which the chromosomes are arranged at the equator of the cell during its division.   [.......................]

2. A. You are a researcher at biological laboratories and you have been making a study on many cells of different living organisms, after the microscopic examination, you find that the nucleus of each cell contains some thread bodies which consist of protein and nuclear acid DNA. Answer the following questions :

1. The name of these thread bodies.

....

2. The number of these thread bodies inside the nuclei of cells of different living organisms (fixed or different).

....

3. The importance of DNA for living organisms.

....

B. Correct the underlined words :

1. Chromosomes arranged along the cell equator in the **anaphase**.   [.......................]

2. The number of chromosomes in somatic cells is a **haploid** number. [.......................]

3. The nucleolus disappears during the mitotic cell division in **telophase**.

[.......................]

3. Complete the following statements :

1. The number of chromosomes in the living organisms is .... from a species to another, while it is .... in members of the same species.

2. .... and .... are two types of cell division.

3. The .... contains the genetic material which consists of a number of .... that have the main role in cell division.

4. The human body contains two types of cells, which are .... and ....

5. In human, all somatic cells contain .... chromosomes, while the gametes contain .... chromosomes.

6. .... division happens in somatic cells and it leads to the growth of the living organism.
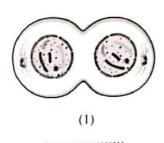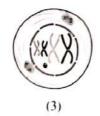
4. A. Give reasons for :

1. Cellular division begins with interphase.

....

....
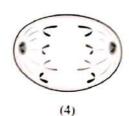
2. Shrinking of spindle fibers during the anaphase of mitotic cell division.

....

....

B. Name only these stages of mitosis :

(1)   (2)   (3)   (4)

....

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C. Choose from column (B) what suits in column (A) :

(A)	(B)
1. Centromere	a. Divide mitotically.
2. Somatic cells	b. Don't divide at all.
3. Gametes	c. It is the point of connection of the two chromatids.
4. Neural cells	d. Contain half number of chromosomes.

Worksheet 14
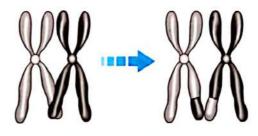
1. A. Compare between :

Mitotic cell division (mitosis) and meiotic cell division (meiosis) according to :

a. The site of occurrence.

b. The number of chromosomes in the resulted cells.

Points of comparison	Mitotic cell division (Mitosis)	Meiotic cell division (Meiosis)
a. The site of occurrence :	....	....
b. The number of chromosomes in the resulted cells :	....	....

B. Explain the following phenomenon and state what is its importance ?

....

....

....

2. A. Choose the correct answer :

1. If the skin cells in man contain 46 chromosomes, so the sperms of the male contain .... chromosomes.

   a. 23　　　　　　b. 32　　　　　　c. 46　　　　　　d. 64

2. In the first meiotic division, the cell divides to form .... cells.

   a. two　　　　　　b. four　　　　　　c. six　　　　　　d. eight

3. Meiotic cell division is responsible for the ....

   a. growth of organisms.　　　　b. compensation of damaged cells.

   c. production of gametes.　　　　d. duplication of cells number.

4. Gametes resulted from the .... cell division.

   a. reduction　　　b. meiotic　　　c. mitotic　　　d. (a)&(b) are correct.

B. Write short notes about :

1. Prophase I in the first meiotic division.

....

....

....

....

....

2. Anaphase I in the first meiotic division.

....

....

....

3. A. Put (✓) or (✗) :

1. Second meiotic division aims to form two cells, each of them contains half number of chromosomes.　　　　　　　　　　　　　　　　　　( )

2. DNA is duplicated only once during meiosis.　　　　　　　　　( )

3. Mitotic cell division is called by reduction division.　　　　　　( )

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4. Gametes in living organisms are produced by special cells known as

the somatic cells. ( )

5. Mitotic division produces cells that contain half of the genetic material. ( )

6. Reproductive cells are divided by mitosis which leads to the formation

of gametes. ( )

7. Crossing over occurs in the telophase in the first meiosis. ( )

B. Give reasons for :

1. The meiotic division is considered as a source for genetic variation on which

the variation of living organisms depends on.

....

2. Mitotic division differs from second meiotic division although they are similar in

their phases.

....

3. Nanotechnology is called by this name.

....

4. The opposite figure shows a type of cell division that takes place

in a living cell containing 4 chromosomes,

answer the following questions :

Through 8 phases

1. Draw the shapes of chromosomes in the four cells produced

from this division.

....

2. Mention the type of the division.

....

3. What type of cells does this division takes place in. What is the importance of

its occurrence ?

....

Worksheet 15

1. A. Write the scientific term for each of the following :

1. It is formed as a result of the combination of the male gamete and the female one.

[........................]

2. The combination of the male gamete and the female gamete to form a new structure.

[........................]

3. The most common asexual reproduction in fungi and algae.   [........................]

B. Give reasons for :

1. Sexual reproduction is a source of the genetic variation.

....

....

2. Asexual reproduction produces offspring with genetic traits identical to those of their parents.

....

....

3. Binary fission is considered as mitotic division.

....

2. A. Correct the underlined words :

1. The yeast fungus reproduces by **regeneration**.   [........................]
2. Sexual reproduction takes place in plants through **spores**.   [........................]
3. Euglena can reproduce asexually by **budding**.   [........................]
4. **Sexual reproduction** maintains the genetic structure of the living organism.

[........................]

B. Look at the opposite figure, then answer the following questions:

1. Label the figure.

① ....

② ....

2. What's the way of the reproduction of this fungus ?

....

3. What does happen when no. ① falls on a suitable environment ?

....

3. Complete the following statements :

1. Asexual reproduction in the bacteria happens by .... , while in hydra by ....

2. In reproduction process, the .... move from parents to their offspring.

3. When the bud remains connected to the parental cell, a .... is formed.

4. During asexual reproduction, the number of parents is .... , while during sexual reproduction is ....

5. .... and .... are from the forms of asexual reproduction.

4. A. What is meant by ... ?

1. Reproduction : ....

....

2. Reproduction by regeneration : ....

....

B. Choose the correct answer :

1. Sexual reproduction depends on the ....

a. formation of gametes only.

b. meiotic division of reproductive cells only.

c. fertilization only.

d. all the previous choices.

2. The ability of some animals to compensate their missing parts is called ....

a. regeneration.   b. budding.

c. forming spores.   d. sexual reproduction.

3. If the number of chromosomes in cells of starfish is (2N), the number of chromosomes in resulted cells after reproduction is ....

a. N   b. 2N   c. $\frac{1}{2}$ N   d. no correct answer

4. .... contains half the genetic material of the individual.

a. Sperm only   b. Ovum only   c. Zygote only   d. (a) and (b)

1. Put (✓) or (×) in front of the following sentences and correct the false ones :

1. Somatic cells are divided by meiotic division which leads to the growth of living ogranisms and the compensation of the damaged cells.

    (   ) ....

2. Reproductive cells are divided by mitosis which leads to the formation of gametes.

    (   ) ....

3. Chromatin reticulum condenses and appears in the form of long thin and double strings (chromosomes) in the telophase of the mitotic division.

    (   ) ....

4. Meiosis results in the formation of two cells, each contains half the genetic material of the parental cell.

    (   ) ....

5. The asexual reproduction produces living organisms similar in their genetic structure.

    (   ) ....

6. Gametes in living organisms are produced by special cells known as the somatic cells during the meiotic division.

    (   ) ....

2. Write the scientific terms for each of the following statements :

1. A phase in which some important vital processes occur to prepare the cell for division and the genetic material in the cell is doubled. [.........................]

2. A phase in which the chromosomes migrate towards the cell equator where each chromosome is connected with one of the spindle fibers at the centromere.

    [.........................]

3. A phase where some processes occur upon which the formation of chromosomes that equal in numbers with the parental cell take place. [.........................]

4. It contributes in genes exchanging between the chromosome's chromatids and distributing them in the gametes. [.........................]

5. A cell division that occurs in the somatic cells and results in the growth of the living organism. [.........................]

6. It results from the combination of a male gamete and a female gamete and contains the diploid number of chromosomes (2N) of the living organism.   [...................]

7. A type of the asexual reproduction that occurs in unicellular living organisms, in which the nucleus is mitotically divided (mitosis) and then the cell which represents the body of the unicellular organism splits into two cells.   [...................]

3 . Explain how sperms and ova are formed in the human being.

....

....

....

4 . Explain using drawing the crossing over phenomenon and its role in the variation of genetic traits among members of the same species.

....

....

....

5 . Compare between each of the following :

1.

Meiosis	Mitosis
....	....
....	....
....	....
....	....
....	....

2.

Sexual reproduction	Asexual reproduction
....	....
....	....
....	....
....	....
....	....

6 . Clarify the importance of each of the following :

1. The meiotic division in keeping the number of chromosomes constant in the same species.

....

2. The sexual reproduction in the occurrence of the genetic variation.

....

3. The asexual reproduction in producing offspring identical to their parents.

....

7. What is the relation between the genetic structure for each offspring and parents in the following cases ? and give the reason.

1. Binary fission in paramecium.

....

....

2. The plant resulted from germination of seeds.

....

....

Model Exams on Unit 4

Model Exam 1

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Answer the following questions :

Question 1   5 marks

The following sentences show some steps of meiosis division, refer each sentence to its right phase, then arrange them below.

1. The centromere of each chromosome splits lengthwise into 2 halves.   [.........................]
2. Formation of 2 cells with a haploid number of chromosomes.   [.........................]
3. Chromosomes pairs arranged at the cell equator.   [.........................]
4. Formation of 4 cells with a haploid number of chromosomes.   [.........................]
5. Chromosomes arranged at the cell equator.   [.........................]
6. Formation of a tetrad.   [.........................]

* The arrangement (write only the number of the correct arrangement).

.... ⟶ .... ⟶ .... ⟶ .... ⟶ .... ⟶ ....

Question 2   5 marks

A Give reasons for :

1. Asexual reproduction produces offspring with genetic traits identical to those of their parents.

   ....

2. Meiotic division is called by reduction division.

   ....

3. Crossing over phenomenon is the source of genetic variation between members of the same species.

   ....

B Write the scientific term :

1. The structure that is resulted from the combination of a male gamete and a female gamete and it contains the diploid number of chromosomes (2N) of the living organism.   [.........................]

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2. A phase in which the chromosomes migrate towards the cell equator where each chromosome is connected with one of the spindle fibers at the centromere.

[.........................]

3. A type of reproduction that occurs in higher organisms. [.........................]

4. A division where some processes occur upon which the formation of two cells, each of them contains chromosomes that equal in numbers with the parental cell.

[.........................]

Question 3 — 5 marks

A From the opposite figure, answer the following questions :

1. The opposite figure represents ....
2. Draw the phase which follows this phase.

B Put (✓) or (✗) :

1. The offspring resulted from the asexual reproduction has genetic traits different from the original organisms. ( )
2. Meiotic division occurs in somatic cells. ( )
3. Chromatin reticulum intensifies and appears in the form of long, thin and double strings in the telophase of mitosis. ( )
4. Sexual reproduction maintains the genetic structure of the living organism. ( )

C 1. Show by drawing the reproduction by budding.

....
....
....
....
....

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2. Mention the difference between the spore and the zygote.

The spore	The zygote
....	....
....	....
....	....

Question 4   5 marks

A Compare between :

1. Meiosis and mitosis (3 points only).

Meiosis	Mitosis
....	....
....	....
....	....

2. Somatic cells and reproductive cells [according to : number of chromosomes – number of produced cells – type of division].

P.O.C.	Somatic cells	Reproductive cells
Number of chromosomes :	....	....
Number of produced cells :	....	....
Type of division :	....	....

B Mention the type of asexual reproduction in each of the following figures :

Fig. (1)

....

Fig. (2)

....

Fig. (3)

....

Model Exam 2

20

Answer the following questions :

Question 1 — 5 marks

A What is meant by ...?

1. Reproduction.

....

....

2. Crossing over phenomenon.

....

....

B If you know that, the number of chromosomes in a human somatic cells equals 23 pairs, calculate the number of chromatids in the following :

1. Sperm.   [.........................]

2. Metaphase.   [.........................]

3. Metaphase 2   [.........................]

4. Adult red blood cell.   [.........................]

C Look at the opposite fig. , then complete :   (A)

1. This figure represents .... which chemically consists of protein and ....

2. Letter (A) represents ....

3. Letter (B) represents ....

(B)

Question 2 — 5 marks

A Choose the correct answer :

1. .... is a vital process that the life of the living organism does not depend on.

   a. Feeding   b. Reproduction   c. Growth   d. Respiration

2. Yeast is a ....

   a. unicellular bacteria.   b. plant.

   c. multicellular fungus.   d. unicellular fungus.

3. Reproduction by spores is one of the methods of reproduction in ....

   a. bread mould fungus.   b. yeast fungus.

   c. amoeba.   d. colcasia.

4. Mitotic cell division takes place in .... cells.

   a. skin   b. testis   c. ovary   d. nervous

5. Meiotic cell division takes place in .... cells.

   a. ovary   b. testis   c. anther   d. (a) , (b) and (c)

6. Separation of chromatids takes place in ....

   a. anaphase.   b. metaphase.   c. telophase.   d. prophase.

B **Compare between** : Sexual reproduction and asexual reproduction.

Sexual reproduction	Asexual reproduction
....	....
....	....
....	....
....	....
....	....

Question **3** *5 marks*

A **Complete the following statements :**

1. The number of chromosomes is .... in the individuals of the same species, while it is .... from a species to another.

2. Vegetative reproduction in plants needs no .... , but these plants reproduce by .... organs.

3. In prophase I, chromosomes are arranged in .... pairs, each pair consists of four chromatids which are called ....

4. When the male gamete fuses with the female gamete, ... is formed.

B **Correct the underlined words :**

1. Asexual reproduction depends on the **meiotic** cell division.

                                                  [.......................]

2. **Mitotic** cell division is called reduction division.

                                                  [.......................]

3. The spindle fibers appear during **interphase**.

                                                  [.......................]

Question ④ 5 marks

A Choose from column (B) what suits in column (A) then rewrite the whole sentence :

(A)	(B)
1. The spindle fibers contract to withdraw the chromatids to one pole of the cell in	a. prophase.
2. Duplication of genetic material occurs in	b. interphase.
3. The nucleolus and nuclear membrane disappear in	c. metaphase.
4. Chromosomes are arranged along the cell equator in	d. anaphase.

1. ....   2. ....   3. ....   4. ....

B Give reasons for :
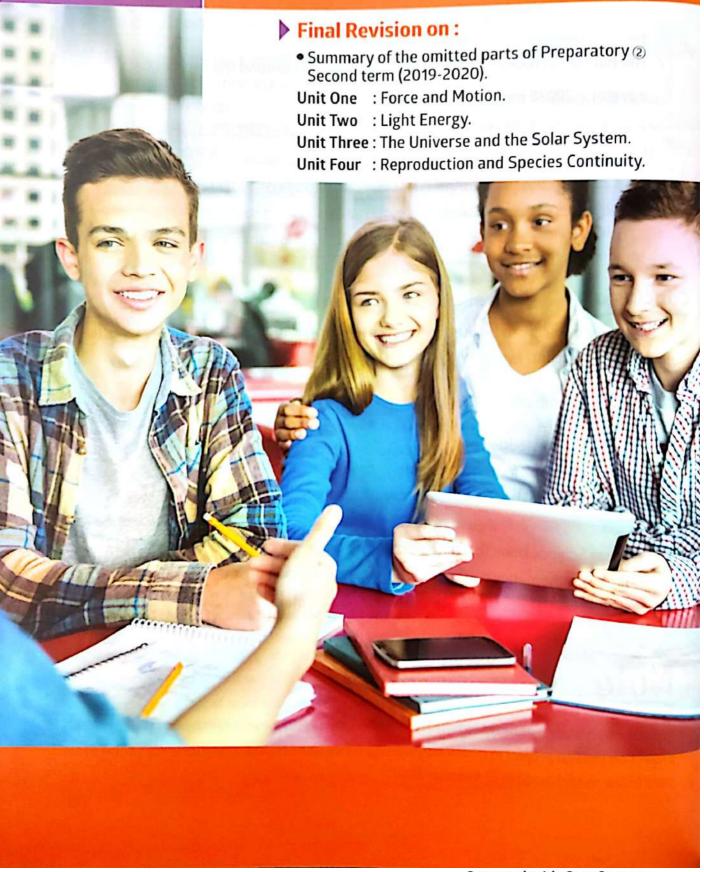
1. The number of chromosomes remains constant in the cells of members of the same species.

....

2. Cellular division begins with interphase.

....

C If the number of chromosomes in the liver cells of a living organism is (32), what is the number of chromosomes in the reproductive cells ?

....

PART 2

Final Revision

▶ **Final Revision on :**

- Summary of the omitted parts of Preparatory ② Second term (2019-2020).

Unit One : Force and Motion.

Unit Two : Light Energy.

Unit Three : The Universe and the Solar System.

Unit Four : Reproduction and Species Continuity.

Unit 2 Lesson Two — Wave Nature of Light

Visible Light

* Visible light is considered one of the components of electromagnetic spectrum.

Visible light

Electromagnetic waves of wavelength ranges between 380 : 700 nanometre.

Speed of light

It is the distance covered by light in one second.

Analysis of white light

Visible light →

Visible light is known as white light and it consists of a **mixture of seven colours** known as **spectrum colours**

Triangular glass prism

Triangular glass prism is used to analyse the white light into **seven spectrum colours** as the following figure :

White light

Red
Orange
Yellow
Green
Blue
Indigo
Violet

Wavelength decreases
Frequency increases

Triangular glass prism
"Analysis of White light"

Red Light
- The closest to the prism apex.
- Lowest frequency.
- Longest wavelength.
- Lowest deviation.

Violet Light :
- The closest to the prism base.
- Highest frequency.
- Shortest wavelength.
- Highest deviation.

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Energy of light waves

⊃ The German scientist Max Planck proved that the light wave is composed of energy quanta known as "Photons" and the energy of the photon is **directly** proportional to the frequency of the light wave.

∴ **Photon energy** = Constant × Photon frequency

- The constant value is known as Planck's constant.

Light behaviour through different media

Media can be classified according to their ability to allow light to pass through, into :

A	B	C
Transparent medium	**Translucent (semi-transparent) medium**	**Opaque medium**

A - Transparent medium

It is the medium, which permits most light to pass through , so objects can be seen clearly behind it.

Such as :
• Glass.   • Air.

B - Translucent (semi-transparent) medium

It is the medium, which permits only a part of light to pass through and absorbs the remaining part, so objects can be seen less clearly behind it.

Such as :
• Frosted (flint) glass.

C - Opaque medium
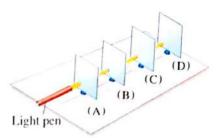
It is the medium, which doesn't permit light to pass through, so objects can't be seen behind it.

Such as :
• Milk.   • Skin.

* *By increasing the thickness of the transparent medium or translucent medium, the quantity of light that passes through it decreases.*

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Light travels in straight lines

Light travels through transparent media in straight lines whose thickness can be controlled.

(D)
(C)
(B)
(A)
Light pen

Light propagates in straight lines.

Light intensity (brightness)
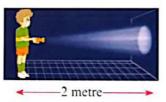
Light intensity :

It is the quantity of light falling perpendicular to a unit area of a surface in one second.

←—1 metre—→

The inverse square law of light :

The light intensity of a surface is inversely proportional to the square of the distance between the surface and the source of light.

←——2 metre——→

FIRST — *Light reflection*
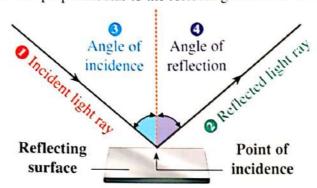
Light reflection :

It is the rebounding (returning back) of light waves in the same medium on meeting a reflecting surface.

➲ **To study light reflection, we should know some concepts related to it.**

The line perpendicular to the reflecting surface (**normal**)

❸ Angle of incidence
❹ Angle of reflection
❶ Incident light ray
❷ Reflected light ray
Reflecting surface
Point of incidence

❶ The incident light ray :

It is a narrow light beam which is represented by a straight line, it intersects with the reflecting surface at the point of incidence.

❷ The reflected light ray :

It is a narrow light beam which is represented by a straight line, it is reflected from the reflecting surface at the point of incidence.

❸ Angle of incidence :

It is the angle between the incident light ray and the line perpendicular to the reflecting surface at the point of incidence.

❹ Angle of reflection :

It is the angle between the reflected light ray and the line perpendicular to the reflecting surface at the point of incidence.

Two laws of light reflection :

The reflection of light is governed by two laws :
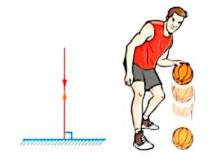
First law : *Angle of incidence = Angle of reflection*

Second law : *The incident light ray, the reflected light ray and the normal to the surface of reflection at the point of incidence, all locate in one plane perpendicular to the reflecting surface.*
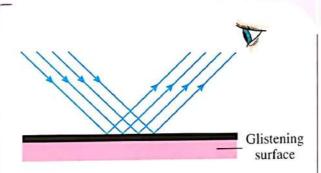
* When a light ray falls perpendicular on a reflecting surface, it bounces back on itself, because both of angle of incidence and angle of reflection are equal to zero.

Types of light reflection :
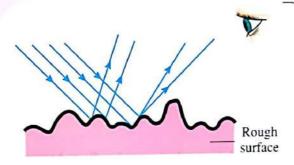
Regular (uniform) reflection	Irregular (non-uniform) reflection
Glistening surface	Rough surface
It is the reflection of light rays in one direction when they fall on a smooth and glistening surface, such as : • A plane mirror. • A thin sheet of aluminium (foil). • A stainless steel sheet.	It is the reflection of light rays in different directions when they fall on a rough surface, such as : • A leaf of a tree. • A piece of leather. • A piece of wool.

The two laws of light reflection apply to both types of reflection

SECOND — Light refraction

Optical density of the medium :

It is the ability of the transparent medium to refract light.

Air
Glass

Refraction of light

Light refraction :
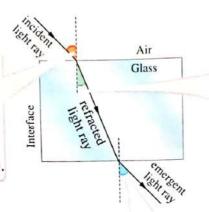
It is the change of light path when it travels from a transparent medium to another transparent medium of different optical density.

Concepts related to light refraction :

Angle of incidence :

It is the angle between the incident light ray and the normal at the point of incidence on the interface.

Air

Glass

Angle of refraction :

It is the angle between the refracted light ray and the normal at the point of incidence on the interface.

Angle of emergence :
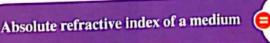
It is the angle between the emergent light ray and the normal at the point of emergence on the interface.

∗ When it travels in an inclined position from air to glass or from glass to air :

- The path of light ray changes (refracts).
- The angle of incidence is not equal to the angle of refraction but it equals to the angle of emergence.
- The incident light ray is parallel to the emergent light ray.

Absolute refractive index of a medium

Absolute refractive index of a medium :

It is the ratio between the velocity of light through air to the velocity of light through another transparent medium.
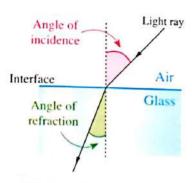
Absolute refractive index of a medium $=$ $\dfrac{\text{Velocity of light through air}}{\text{Velocity of light through the medium}}$

∗ The velocity of light through air is greater than that through any other transparent medium and decreases when it travels to any other transparent medium, so the absolute refractive index of any transparent medium is always greater than one.

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- When a light ray travels in an inclined position from a transparent medium of **lower** optical density to another of **higher** optical density.

- When a light ray travels in an inclined position from a transparent medium of **higher** optical density to another of **lower** optical density.

- When a light ray falls **perpendicular to** the interface between two different transparent media.
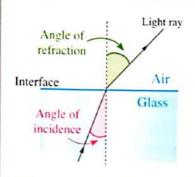
So, the light ray

refracts near the normal.

refracts far from the normal.

passes without refraction.
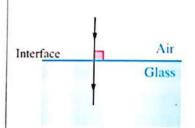
The angle of incidence **is greater than** the angle of refraction.

The angle of incidence **is smaller than** the angle of refraction.

The angle of incidence **is equal to** the angle of refraction **equals zero.**

∴ **From the conditions of light refraction :**

Incidence of the light ray in an inclined position on the interface between two different transparent media in optical density. (i.e.: The angle of incidence is not equal to zero).

Natural phenomena related to reflection and refraction of light :

1 Apparent shapes of objects :

A pencil, which is partially immersed in water appears as being broken.

Due to the refraction of light rays coming from the immersed part in water.

Pencil image due to light refraction

2 Apparent positions of objects :
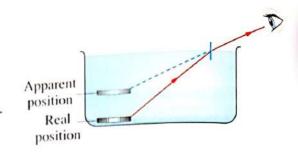
The submerged object in water is seen in an apparent position slightly above its real position.

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Due to the refraction of light rays coming from the submerged object (far from the normal) where, the eye sees this object in an apparent position on the extensions of these refracted rays.

Apparent position

Real position

* To determine the real position of an object completely immersed in water, we must look at it vertically.

3 Mirage :

Mirage :

It is a natural phenomenon that takes place on the desert roads at noon especially in the summer times, where objects on the road sides seem as if they have inverted images on a wet area.

hot air

hottest air
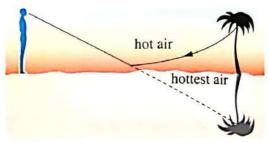
Illustration of mirage phenomenon

This phenomenon occurs due to reflection and refraction of light in air layers which differ in the degree of temperature.

Unit 3 Lesson One — Reproduction in plants

Reproduction process

It is a biological process aims to secure the existence and continuity of living organisms species by producing new individuals from the same species to prevent them from extinction.

⊙ **Reproduction in plants occurs by two ways :**

First : *Sexual reproduction :* Through female and male reproductive organs of flowers.

Second : *Asexual reproduction (vegetative) :* Through different vegetative parts of plant except flowers.
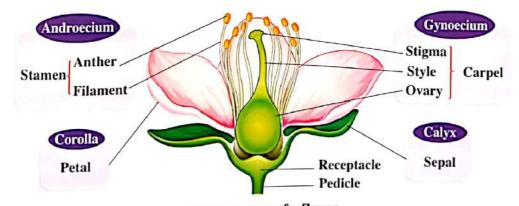
FIRST — *Sexual reproduction*

Flower :

It is a short stem whose leaves are modified into reproductive organs.

⊙ The flower is the organ of sexual reproduction in flowering plants and it arises from a **floral bud** which emerges from the axle of a leaf called **bract**.

⊙ The axle may carry a number of flowers known as **inflorescence**.

⊙ The flowers consist of a thin neck (**pedicle**) ends in a swollen part (**receptacle**) which carries the floral leaves in four different whorls :

Androecium — Stamen { Anther, Filament } — Corolla — Petal — Stigma, Style, Ovary } Carpel — Gynoecium — Calyx — Sepal — Receptacle — Pedicle

The structure of a flower

Floral whorl	Arrangement	Composition	Function
① Calyx	First (outermost) whorl	Green leaves called **sepals**	Protection of the inner parts of the flower specially before blooming.
② Corolla	Second whorl	Bright coloured scented leaves called **petals**.	* Protection of the reproductive organs. * Attraction of insects to the flower, which help in the reproduction process.
③ Androecium (male reproductive organ)	Third whorl	* Leaves known as "stamens". * Each stamen consists of a fine **filament** ends in a sac known as the **anther**.	* Production of pollen grains.
④ Gynoecium (Female reproductive organ)	Fourth (innermost) whorl	* Leaves known as "carpels". * Each carpel consists of a swollen part called the **ovary**, which is connected with a tube called the **style**, which ends in an opening called the **stigma**.	* Production of ovules.

⊙ The flower is considered as a typical flower if it contains the four different floral whorls.

⊙ Flowers are different from each other in the separation or fusion of the **sepals** and **petals**, like in the flowers of Wallflowers (Manthoor) and Petunia.

⊙ The sex of the flower is differ according to what it carries from male or female organs or both of them together, as it may be :

- **Bisexual flower (hermaphrodite)**, if it contains both male reproductive organ (androecium) and female reproductive organ (gynoecium) and its symbol is ♀ such as the flower of :

- Tulip
- Petunia
- Wallflower.
- Pea
- Cotton
- Linen.

- **Unisexual flower,** if it contains either male reproductive organ (androecium) only, its symbol is ♂ or female reproductive organ (gynoecium) only, its symbol is ♀ such as the flower of :
- Palms.
- Maize.
- Pumpkins.

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Steps of sexual reproduction in plant

1 Pollination :

Pollination

It is the process of transfer of pollen grains from the anthers of a flower to the stigmas.

Types of pollination :

Self (auto) pollination	Mixed (cross) pollination
### Self (auto) pollination	### Mixed (cross) pollination
It is the transfer of pollen grains from the anthers of a flower to the stigmas of the same flower or to another flower in the same plant.	It is the transfer of pollen grains from the anthers of a flower to the stigmas of another flower in other plant of the same kind.
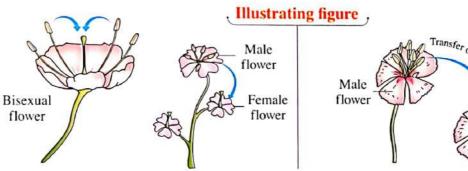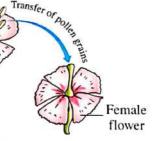
Illustrating figure

Bisexual flower

Male flower

Female flower

Transfer of pollen grains

Male flower

Female flower

Methods of mixed (cross) pollination

Pollination by air (wind)	Pollination by insects	Artificial pollination
Some characteristics of flowers in which pollination occurs by air : • The anthers are hanged. • Stigmas are feathery like and sticky. • The pollen grains are light in weight and dry and produced by huge numbers.	**Some characteristics of flowers in which pollination occurs by insects :** • Petals are coloured and scented. • Pollen grains are sticky or having coarse surfaces.	**This method of pollination is carried out by man.** **Example :** The gardener in pollination process of palm trees spread pollen grains over their female flowers.

2 Fertilization :

Fertilization in plants :

It is the process of fusion of the nucleus of the male cell (pollen grain) with the nucleus of the female cell (ovum) to form the zygote.

Zygote :

The cell resulting from the fusion of a pollen grain and an ovum nuclei.

Stages of fertilization process in plants :

* After pollination, the pollen grain sticks on the stigma, which secretes sugary solution.
* The pollen grain germinates forming a pollen tube (containing *2 male nuclei*).
* The pollen tube extends through the style till it reaches the ovule inside the ovary through the **micropyle**.
* The end of the pollen tube degenerates and one of the 2 male nuclei fuses (combines) with the ovum (egg cell) forming a fertilized ovum which is known as "zygote".
* The zygote undergoes successive divisions to form the *embryo* which grows forming a new plant.

Zygote

* After completion of fertilization process :

* The ovule develops to become a seed and its wall develops to become the seed coat.
* The ovary develops to become a fruit and its wall develops to become the outer coat of the fruit.
* Fruits differ from each other according to the nature of the ovary, because the ovary that contains :
* **One ovule** gives a fruit with **a single seed** such as :
  * Olives.
  * Peaches.
* **Many ovules** give a fruit with **many seeds** such as :
  * Beans.
  * Peas.

SECOND   Asexual reproduction (vegetative)

Vegetative reproduction :

It is a process of producing new individuals from different parts of the plant without the flower having a role in this process.

➔ Kinds of vegetative reproduction :

1. Natural vegetative reproduction.

2. Artificial vegetative reproduction.

1 Natural vegetative reproduction :

- It takes place by :
  - Rhizomes.
  - Corms.
  - Tubers.
  - Bulbs.
  - Offshoots.

Reproduction by tubers :

Tuber :

It is a swollen part from a horizontal root or a terrestrial stem, which contains growing buds and it is used for vegetative reproduction.
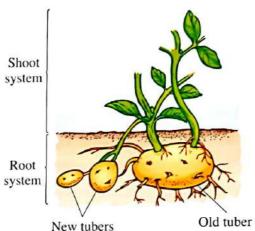
* Some buds grow forming a root system which grows down.

* Other buds grow forming a shoot system which grows up.

* After some days, the old tuber changes into a plant that carries many new tubers.

The tuber is :

A horizontal root as sweet potatoes.

or

A terrestrial stem as potatoes.

Shoot system

Root system

New tubers   Old tuber

2 Artificial vegetative reproduction :

It takes place by :

- Cutting.
- Grafting.
- Tissue culture.
- Layering.

A Reproduction by cutting :

The cut :

It is a part of root, stem or leaf that is taken from a plant for reproduction.

Bud

Cut

The cut containing growing buds

- The buds buried inside the soil grow to form the root system of the plant, but the buds above the soil surface grow to form the shoot system of the plant.

* From examples of plants that reproduce by cutting :

- Grapes.
- Roses.
- Sugar cane.

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B Reproduction by grafting :
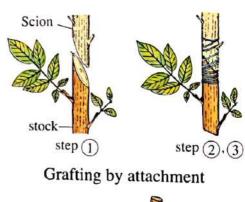
Reproduction by grafting :
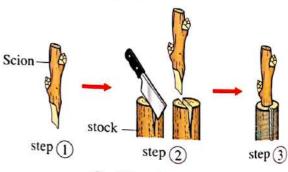
It is a kind of artificial vegetative reproduction in which a part of plant which contains more than one bud known as scion is selected to be placed on a branch of another plant known as the stock.

* This kind of reproduction is used only between highly similar plant species such as : :

* Oranges and naring (bitter orange).
* Apples and pears.
* Peaches and apricots.

Methods of grafting :

1. **Grafting by attachment :** as in the steps in the opposite figure and this method is used in mango plant.

2. **Grafting by wedge :** as in the steps in the opposite figure and this method is used in large trees.

* The produced fruits from grafting by attachment and grafting by wedge belong to the same type of the **scion**.

Scion

stock

step ①   step ②,③

Grafting by attachment

Scion

stock

step ①   step ②   step ③

Grafting by wedge

C Tissue culture :

Tissue culture :

It is a process of multiplying a small part of a plant to get many identical parts.

* The tissue is separated from the upper part of the stem and is placed in a nutritive medium containing **nutrients** and **hormones**, so the new plant starts to grow till certain size and is transferred to the soil to grow normally.

Unit 3 Lesson Two — Reproduction in Man

Reproduction process aims to secure the existence and continuity of living organisms species to protect them from extinction.

⊙ Man can't reproduce asexually, but he can only reproduce sexually.

⊙ Sexual reproduction occurs by special systems called reproductive (genital) systems.

FIRST — The male reproductive (genital) system

Ureter

Urinary bladder

Vas deferens

Urethra (urinary genital duct)

Seminal vesicle
Prostate gland
Cowper's gland } **Associated glands**

Penis

Epididymis

Urinary genital opening

Testis

Scrotal sac

— Male reproductive system —

➲ The male reproductive system consists of 4 main parts illustrated in the following table :
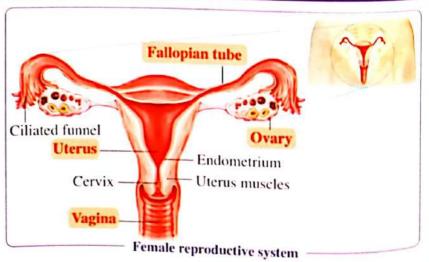
Parts of male reproductive system	Description	Position	Function
① **Two testes**	Two glands of oval (elliptical) shape	Locate outside the body in a sac like structure called **scrotal sac (scrotum)** to keep and regulate the temperature of testes 2°C below the normal body temperature and it is hanged between male's thighs.	• Production of sperms • Production of male sex hormone known as "testosterone" which is responsible for the appearance of secondary male sex characters (signs of puberty in male) such as : - Growth of hair in certain body areas (like beard and mustache). - Harshness of voice. - Development of genital organs. - Growth of bones. - Enlargement of muscles.

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② The vas deferens	Each testis is connected to a group of fine convoluted (highly looped) tubes known as "Epididymis" which extends in the form of a single tube known as "Vas deferens".	Between the testis and urinary genital duct.	**In epididymis :** • The final stages of the growth and development of sperms take place. • Sperms storage take place. **In vas deferens :** The sperms are transferred from the testis to the urinary genital duct (urethra).
③ Genital associated glands :	Three glands which are : • Two seminal vesicles. • Prostate gland. • Two Cowper's glands.	Connected to the male reproductive system.	Secretion an alkaline fluid known as seminal fluid which works on : • Nourishes (feeds) the sperms (as it contains nutrients). • Facilitates the flow of sperms. • Neutralizes the acidity of urethra (so sperms don't die during passing through urethra).
④ The penis	An organ consists of a sponge-like tissue.	The urethra passes through it and ends in a urinary genital opening.	The semen and urine go out of the body through the penis but never at the same time.

SECOND — **The female reproductive (genital) system**

➲ The female reproductive system consists of 4 main parts illustrated in the following table :

Female reproductive system
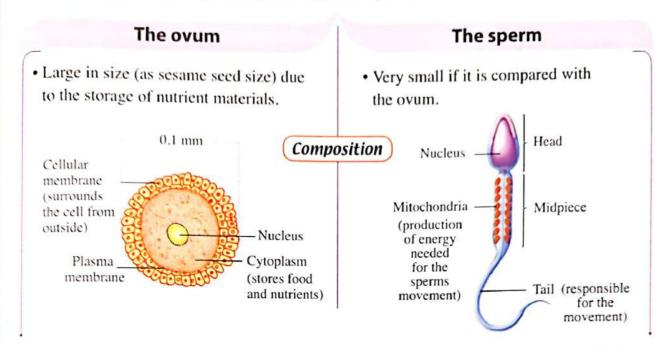
Parts of female reproductive system	Description	Position	Function
① **Two ovaries**	Two glands having the size of a peeled almond.	Locate inside the body in the lower part of the abdominal cavity from the back.	• Production of ova, in a process known as **ovulation**. • Production of female sex hormones, which are : * Progesterone, which is responsible for the continuity of pregnancy. * Estrogen, which is responsible for the appearance of secondary female sex characters (signs of puberty in female) such as: - Growth of hair in armpit and pubic. - Softness of voice. - Growth and development of breasts. - Accumulation of fats in some body regions. - Occurrence of menstrual cycle every 28 days, as long as no pregnancy happens. (Menstrual cycle starts at the age of **female puberty** (11 to 14 years) and stops at the age of **menopause** (45 to 55 years).
② **Two fallopian tubes**	• Two tubes of funnel-shaped opening provided with finger-like projections. • The inner wall of them lined with cilia.	Locate near the ovaries and end at the upper corners of the uterus.	Receiving the ripe ovum and directing it towards the uterus with the aid of : • The contractions and relaxations of the muscles in the tubes wall. • The movement of the lining cilia.

③ The uterus	- A hollow pear-shaped organ. - Has a muscular wall that can expand as the fetus grows during pregnancy. - Lined with mucus membrane rich in blood capillaries to form *placenta* during pregnancy	Locates in the pelvic cavity between the urinary bladder and the rectum.	• Protection the fetus until birth. • Nourishment the fetus during pregnancy by *placenta* through the *umbilical cord*.
④ The vagina	A muscular tube.	Extends from the uterus and ends in the external genital opening.	Expands during the labour to deliver (coming out) the baby.

The structure of the ovum and sperm in human
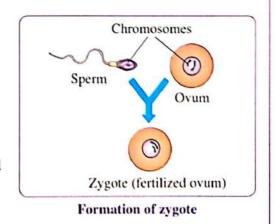
- You know that the body of a living organism consists of cells, each cell contains a nucleus that contains the complete number of chromosomes (genetic material) (46 chromosomes) of the species.

  - Chromosomes carry genes, which are responsible for the hereditary traits of the organism.

- The ovum and sperm differ from any other body cells in the number of chromosomes in the nucleus, where the nucleus of a sperm or an ovum contains only half number of chromosomes [23 chromosomes].

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⋆ Comparison between the ovum and the sperm :

The ovum	The sperm
• Large in size (as sesame seed size) due to the storage of nutrient materials.	• Very small if it is compared with the ovum.

Composition

The ovum diagram:
0.1 mm
Cellular membrane (surrounds the cell from outside)
Plasma membrane
Nucleus
Cytoplasm (stores food and nutrients)

The sperm diagram:
Nucleus — Head
Mitochondria (production of energy needed for the sperms movement) — Midpiece
Tail (responsible for the movement)

Stages of fertilization process and embryo formation in human

• During mating, the male secretes billions of sperms, which move from the vagina towards the uterus then to fallopian tube.

• The sperms rush the ovum at the beginning of fallopian tube.

• The head of the sperm secretes enzymes (chemical substances) to dissolve the cellular membrane of the ovum and facilitate its penetration inside the ovum.

• One sperm only can penetrate the cellular membrane of the ovum and the ovum surrounds itself with a membrane that prevents the penetration of any other sperm.

• Fertilization occurs by merging the nucleus of sperm (which contains 23 chromosomes) with the nucleus of the ovum (which contains 23 chromosomes) to form the *zygote* (fertilized ovum), that contains a nucleus with 46 chromosomes (23 pairs of chromosomes).

• The zygote transfers to the uterus to be implanted in its lining and during that the zygote divides many successive divisions into many cells that differentiate and continue to grow forming the *embryo* (fetus) which carries common characteristics of parents.

Chromosomes
Sperm
Ovum
Zygote (fertilized ovum)

Formation of zygote

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➲ **From the previous, we can define fertilization process and pregnancy period in human as follows :**

Fertilization in human :

It is the process of fusion of the nucleus of sperm with the nucleus of ovum to form the zygote.

The pregnancy period :

The period between the fertilization process and delivery which extends for about 9 months.

Genital system diseases :

* Diseases don't arise from sexual contact such as :
  • Uterine cancer. Prostate cancer.
  • Puerperal sepsis (childbed fever).

* Diseases arise from sexual contact (sexually transmitted diseases "STDs") such as :
  • Gonorrhea.   • Syphilis.   • AIDS.

Incubation period of the disease :

It is the period between the beginning of infection and the appearance of symptoms of the disease.

1 Puerperal sepsis (Fever)	**2 Syphilis**

The microbe, that causes the disease

* Spherical-shaped bacteria.

Spherical bacteria

* Spiral-shaped bacteria.

Spiral bacteria

Methods of infection

1. By droplets from a person infected with bacteria and suffering from throat infection or tonsillitis to a vagina of recently laboured mother.
2. An infected wound during the labour.

1. Sexual contact with an infected person or a carrier.
2. From a pregnant woman to her fetus (through the umbilical cord or during the delivery).

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1 Definitions (or scientific terms) :

1. Motion :	It is the change of an object position (location) as time passes according to the position of another fixed object.
2. Speed :	* It is the distance moved through a unit time. *OR* * It is the rate of change of distance.
3. Regular (uniform) speed :	It is the speed by which the object moves when it covers equal distances at equal periods of time.
4. Irregular (non-uniform) speed :	* It is the speed by which the object moves when it covers unequal distances at equal periods of time. *OR* * It represents the speed by which the object moves when it covers equal distances at unequal periods of time.
5. Average speed :	* It is the total distance covered by the moving object divided by the total time taken to cover this distance. *OR* * It represents the regular speed by which the object moves to cover the same distance at the same period of time.
6. Relative speed :	It is the speed of a moving object relative to a constant or a moving observer.
7. Acceleration :	* It is the change of an object speed in one second in a specific direction. *OR* * It is the rate of change of speed.
8. Uniform acceleration :	It is the acceleration by which an object moves in a straight line when its speed changes by equal values through equal periods of time.
9. Positive uniform acceleration :	It is an acceleration by which an object moves in a straight line when its speed increases by equal values through equal periods of time.
10. Negative uniform acceleration :	It is an acceleration by which an object moves in a straight line when its speed decreases by equal values through equal periods of time.
11. Physical quantity :	It is any quantity that can be determined and has a measuring unit in our life.
12. Scalar physical quantity :	It is the physical quantity that has magnitude only and has no direction.

13. Vector physical quantity :	It is the physical quantity that has magnitude and direction.
14. Displacement :	It is the distance covered at a certain direction from the primary position of movement towards its final position.
15. Amount of displacement :	It is the length of the shortest straight line between two positions (primary position and final position).
16. Distance :	It is the actual length of the path that a moving object covers from the starting point to the ending point.
17. Velocity :	* It is the rate of change of displacement. *OR* * It is the displacement covered by the object in one second (a unit time).

2 What is meant by ... ?

1. The change of an object position as time passes :	The object is in a state of motion.
2. An object moving in a straight line, covers a distance of 20 metres in one second :	The object moves at a regular speed of the object is 20 m/sec.
3. A moving car covers a distance of 80 km in two hours :	The speed of the car is 40 km/h.
4. A car covers equal distances at equal periods of time :	The car moves at a regular (uniform) speed.
5. The distance covered by an object is changed by 2 metres each second :	The object moves at a regular speed equals 2 m/sec.
6. The speed of a body = Zero :	The body is at rest.
7. A car moving at a uniform speed = 80 km/h :	The car covers a distance 80 km. each one hour.
8. A moving car covers equal distances at unequal periods of time :	The car moves at an irregular speed.
9. The average speed of a moving car is 70 km/h :	The total distance covered by the moving car through one hour equals 70 km.
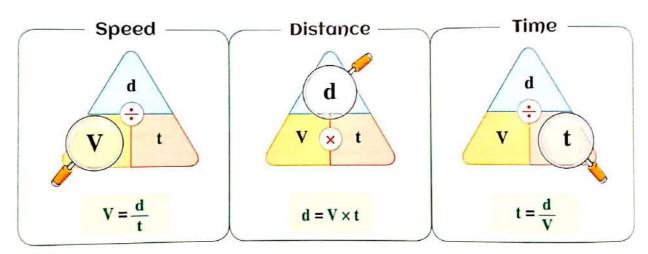
10. The relative speed of a moving car equals 70 km/h. relative to an observer which moves in the opposite direction at a speed of 20 km/h :	The real speed of the car = 70 – 20 = 50 km/h.
11. The relative speed of a train equals 90 km/h :	The speed of the train relative to an observer equals 90 km/h.
12. The ratio d/t for a moving body is constant :	The body moves at a regular speed.
13. The slope of the straight line in graphic relationship (distance - time) of a moving body equals 30 :	The body moves at a regular speed which equals 30 m/sec. or km/h.
14. The change in the object speed per a unit time equals 5 m/sec^2. :	The object moves with acceleration equals 5 m/sec^2.
15. A body moves at a uniform acceleration = 2 m/sec^2. :	The body moves in a straight line and its speed changes by 2 m/sec. each one second.
16. A body moves at acceleration = – 3 m/sec^2 :	The body moves at a negative acceleration, where its speed decreases by 3 m/sec. each one second.
17. A car moves at a speed of 20 m/sec. and after 5 sec. its speed becomes 15 m/sec. :	$a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{15 - 20}{5} = -1$ m/sec^2. The car moves at a negative acceleration equals –1 m/sec^2
18. An object moves by increasing uniform acceleration = 5 m/sec^2. :	The object moves in a straight line and its speed increases by 5 m/sec. each one second.
19. A body moves at zero acceleration :	The body moves at a uniform speed.
20. Length is a scalar physical quantity :	This means that to describe the length, it is enough to know its magnitude only and its measuring unit.
21. Force is a vector physical quantity :	This means that to describe the force, it is necessary to know its magnitude, its measuring unit and its direction.
22. A body moves a distance 60 m and the amount of displacement equals zero :	The final position of the movement of this body is the same primary position.
23. The displacement of an object is 50 metres in east direction :	The distance covered in the east direction from primary position of movement to its final position equals 50 m.
24. The displacement equals the covered distance :	This means that the body moves in a straight line in one direction.

25. A body covered a distance 40 m northward direction in 20 sec :	The average velocity of this body equals 2 m/sec. in the northward direction.
26. The distance which an object travels in the east direction equals 30 m :	The displacement of the object equals 30 m in the east direction.
27. The value of the length of the shortest straight line between two positions equals 5 m :	The displacement equals 50 m.

3 Important laws and solved problems :

1. Speed (V) = $\dfrac{\text{Distance (d)}}{\text{Time (t)}}$

To calculate :

Speed	Distance	Time
$V = \dfrac{d}{t}$	$d = V \times t$	$t = \dfrac{d}{V}$

Problem

A train travels from Cairo to Alexandria a distance of 250 km. in 2 hours. Find its speed (in m/sec).

Solution

Speed (km/h.) $= \dfrac{d}{t} = \dfrac{250}{2} = 125$ km/h.   Speed (m/sec.) $= \dfrac{125 \times 5}{18} = 34.7$ m/sec.

2. Average speed $(\overline{V}) = \dfrac{\text{Total covered distances (d)}}{\text{Total periods of time (t)}}$ $(\overline{V}) = \dfrac{d_1 + d_2 + d_3 + ...}{t_1 + t_2 + t_3 + ...}$

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Problem

A boy on a bike covers 300 metres in a minute and 420 metres in the following minute. Calculate its average speed during :

1. The first minute.   2. The second minute.   3. The two minutes together.

Solution

1. $\overline{V}$ (during the first minute) $= \dfrac{d}{t} = \dfrac{300}{1 \times 60} = 5$ m/sec.

2. $\overline{V}$ (during the second minute) $= \dfrac{d}{t} = \dfrac{420}{1 \times 60} = 7$ m/sec.

3. $\overline{V}$ (during the two minutes together) $= \dfrac{d_1 + d_2}{t_1 + t_2} = \dfrac{300 + 420}{60 + 60} = 6$ m/sec.

3. Relative speed of a moving object relative to :

- An observer doesn't move (at rest) = The real speed of the object.
- An observer moving in the same direction of the object = Object speed – observer's speed.
- An observer moving in the opposite direction of the object = Object speed + observer's speed.
- An observer moving in the same direction by the same speed = Zero.

Problem

Two cars move in the same direction, car (A) moves at a speed of 30 km/h and car (B) moves at a speed of 80 km/h, while car (C) moves in the opposite direction at a speed of 40 km/h.

Calculate the relative speed of car (B) relative to an observer :

1. Stands on the ground.   2. In car (A).   3. In car (C).

Solution
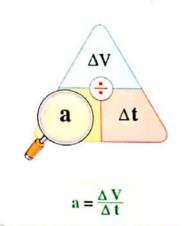
1. The relative speed of car (B) relative to an observer stands on the ground
= 80 km/h.

2. The relative speed of car (B) relative to an observer in car (A) = 80 – 30 = 50 km/h.

3. The relative speed of car (B) relative to an observer in car (C) = 80 + 40 = 120 km/h.

4. Acceleration (a) $= \dfrac{\text{Final speed } (V_2) - \text{Initial speed } (V_1)}{\text{Time in which change occurs } (\Delta t)}$

Note When the body moves, where :
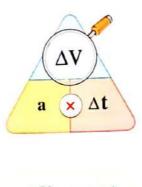
- $V_2 > V_1$ ∴ Its acceleration is positive.
- $V_1 > V_2$ ∴ Its acceleration is negative.

To calculate :
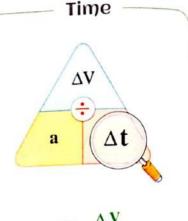
Acceleration	Change in the speed	Time
ΔV ÷ a Δt	ΔV a × Δt	ΔV ÷ a Δt
$a = \dfrac{\Delta V}{\Delta t}$	$\Delta V = a \times \Delta t$	$\Delta t = \dfrac{\Delta V}{a}$

Problems

① *A special car can move from rest and its speed reaches 90 m/sec in 10 seconds. What is the acceleration with which the car moved ?*

Solution

$V_2 = 90$ m/sec. $\qquad\qquad V_1 = 0 \qquad\qquad \Delta t = 10$ sec.

$a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{90 - 0}{10} = 9$ m/sec^2

② *A car moves with a speed 80 m/sec. with a uniform deceleration 2 m/sec^2 If the brake is applied. Calculate its speed after a time 12 sec.*

Solution

$\Delta V (V_2 - V_1) = a \times \Delta t \qquad\qquad a = -2$ m/sec^2

$\therefore V_2 - 80 = -2 \times 12 \qquad\qquad \therefore V_2 = 56$ m/sec.

③ *A moving object, its initial speed 7.5 m/sec. and the acceleration equals 10 m/sec^2 Calculate the time at which the final speed becomes 4 times its initial speed.*

Solution
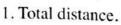
$\Delta t = \dfrac{V_2 - V_1}{a} \qquad\qquad \Delta t = \dfrac{(4 \times 7.5) - 7.5}{10} = 2.25$ sec.

5. Average speed $(\overline{V}) = \dfrac{\text{Total covered distances (d)}}{\text{Total periods of time (t)}}$

Average velocity $(\overrightarrow{V}) = \dfrac{\text{Displacement }(\overrightarrow{d})}{\text{Total time (t)}}$
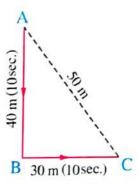
Problems

1 In the opposite figure, a body starts its motion from point (A) to the south to point (B), it covers a distance of 40 metres in 10 seconds, then it directs to the east to point (C) at a distance of 30 metres from point (B) in 10 seconds. Calculate :

1. Total distance.
2. Total time spent by the body.   3. Average speed.
4. Displacement.   5. Average velocity.

Solution
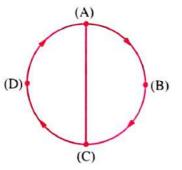
1. Total distance (d) = AB + BC = 40 + 30 = 70 m.

2. Total time (t) = 10 + 10 = 20 sec.

3. Average speed = $\dfrac{\text{Total distance}}{\text{Total time}} = \dfrac{70}{20} = 3.5$ m/sec.

4. Displacement $(\overrightarrow{d}) = \overrightarrow{AC} = 50$ m in eastern south direction.

5. Average velocity = $\dfrac{\text{Displacement}}{\text{Total time}} = \dfrac{50}{20} = 2.5$ m/sec. in the direction $(\overrightarrow{AC})$.

2 A body moves in a circular path, starting from the point (A) to (B) to (C) to (D) and returns back to the start point (A). If the circumference of the path is 300 metres and the body covered the distance (ABC) within 10 seconds, then it covered the distance (CDA) within 20 seconds. Calculate :

1. Total distance moved by the body.
2. Average speed of the body.   3. Displacement.
4. Average velocity.

Solution

1. Total distance (d) = 300 m.

2. Average speed = $\dfrac{\text{Total distance}}{\text{Total time}} = \dfrac{300}{20 + 10} = 10$ m/sec.

3. Displacement = Zero.   4. Average velocity = Zero.
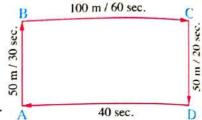
③ A racer covered 50 metres northward within 30 seconds, then 100 metres eastward within 60 seconds, then 50 metres southward within 20 seconds, and then returns back to the start point within 40 seconds.

    1. What is the average speed of the racer ?

    2. What is the displacement ?

    3. What is the average velocity ?

Solution

1. Total distance

    = 50 + 100 + 50 + 100 = 300 m.

    Total time = 30 + 60 + 20 + 40 = 150 sec.
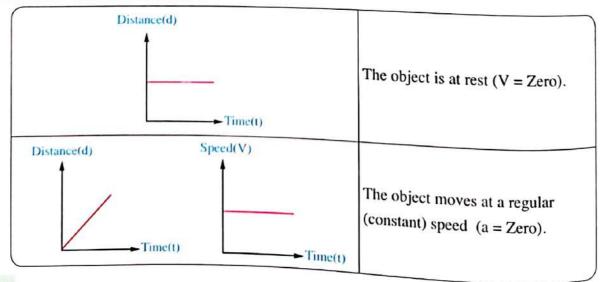
    $\therefore$ Average speed $= \dfrac{\text{Total distance}}{\text{Total time}} = \dfrac{300}{150} = 2$ m/sec.

2. Displacement = Zero "because the end point is the start point".

3. Average velocity = Zero.
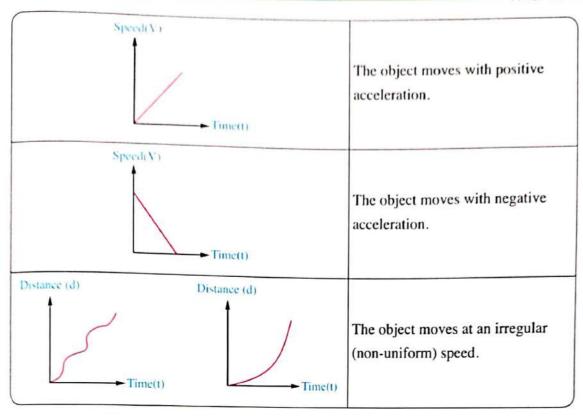
4 Measuring units :

Scalar physical quantity	Its measuring unit
Speed	m/sec *Or* km/h.
Time	Second *Or* Hour
Mass	kg.
Length	Metre

Vector physical quantity	Its measuring unit
Acceleration	m/sec^2
Velocity	m/sec *Or* km/h.
Displacement	Metre
Force	Newton

5 Important graphs :

Distance(d) vs Time(t) — horizontal line	The object is at rest (V = Zero).
Distance(d) vs Time(t) — straight rising line / Speed(V) vs Time(t) — horizontal line	The object moves at a regular (constant) speed (a = Zero).

Speed(V) / Time(t)	The object moves with positive acceleration.
Speed(V) / Time(t)	The object moves with negative acceleration.
Distance (d) / Time(t) Distance (d) / Time(t)	The object moves at an irregular (non-uniform) speed.

6 Give reasons for :

1. **The motion of a train (or metro) can be considered as a motion in one direction.**

   Because the train moves forward or backward in a straight path or curved path or combination of both.

2. **Cars and planes are provided with speedometers.**

   To help us in identifying the speed of cars and planes directly.

3. **The object speed increases by decreasing the time needed to cover a certain distance.**

   Because speed $= \dfrac{\text{distance}}{\text{time}}$ so, speed is inversely proportional to the time.

4. **The speed of a moving object increases as the covered distance increases at a constant time.**

   Because speed $= \dfrac{\text{distance}}{\text{time}}$ so, the speed is directly proportional to the distance.

5. **Car (A) which covers 50 metres in 5 seconds is faster than car (B) which covers 64 metres in 8 seconds.**

   Because the speed of car (A) $= \dfrac{50}{5} = 10$ m/sec. , while that of car (B) $= \dfrac{64}{8} = 8$ m/sec.

6. **The uniform speed of a car cannot be obtained practically.**

   Because the car speed changes according to the conditions of the road and the traffics.

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7. **We say that the underground train moves with an irregular speed.**

Because it covers unequal distances at equal periods of time or it covers equal distances at unequal periods of time.

8. **The relative speed of a moving object in a certain direction differs according to the difference of the observer state.**

Because the relative speed of a moving object when the observer is :

– At rest, the relative speed is equal to the real speed.

– Moving, the relative speed is than the real speed, according to the direction of its movement related to the movement of object.

9. **The moving car seems stable (at rest) to an observer moves at the same speed and the same direction.**

Because the relative speed equals the difference between their speeds equals zero.

10. **Physicists use mathematical relations like graphs and tables in many physical phenomena.**

In order to : – predict the relation between certain physical quantities.

– understand practical results.

– describe physical phenomena in an easier way.

11. **(Distance-Time) graph of an object that moves at a uniform speed is a straight line passing through the origin point.**

Because the distance is directly proportional to the time when the object moves at a constant speed.

12. **The ratio d/t remains constant in case of a body that moves at a uniform speed.**

Because this body covers equal distances at equal periods of time.

13. **(Speed-Time) graph of an object moves at a regular speed is a straight line parallel to the time axis.**

Because the object speed remains constant as time passes.

14. **When the driver of a moving car uses the brakes, we describe the car movement as a decelerating motion.**

Because the car speed decreases as time passes.

15. **The body which moves at acceleration can't move at a regular speed.**

Because its speed changes by passing time.

16. **The acceleration is positive when its value increases, while it is negative when its value decreases.**

Because when moving with a positive acceleration, the final speed is greater than initial speed, while when moving with a negative acceleration, the final speed is less than the initial speed.

17. • **The object which moves at a uniform speed, its acceleration equals zero.**

• **A body moves at zero acceleration**

Because its speed doesn't change by passing time (ΔV = Zero).

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18. It is said that the body moves at uniform acceleration.
Because the body speed changes by equal values through equal periods of time.

19. Mass, length and time are considered scalar physical quantities.
Because they have magnitude only and have no direction.

20. Velocity and force are considered vector physical quantities.
Because they have magnitude and direction.

21. Distance is a scalar quantity, while displacement is a vector quantity.
Because distance is determined by magnitude only, while displacement is determined by magnitude and direction.

22. When an object moves, where its starting point is the ending point, its velocity equals zero.
Because the displacement of this object is zero.

23. The amount of consumed fuel by a plane flies between two cities is differ according to the wind direction.
Because when the plane flies against the wind direction, its velocity decreases and it consumes more fuel and takes more time than that it flies in the same direction of the wind direction.

24. Pilots take in consideration the velocity of the wind during their flights.
Because the direction of the wind affects the velocity of the plane and hence the time of the trip and the amount of the fuel consumed.

7 When the following cases occur ... ?

1. An object moves by the simplest type of movement.
When it moves in a straight line in one direction.

2. The amount of an object's speed equals the amount of distance covered.
When the object covers this distance through a unit time.

3. An object moves at a regular speed.
When the object covers equal distances at equal periods of time.

4. An object moves at an irregular speed.
When the object covers equal distances at unequal periods of time. (or unequal distances at equal periods of time.)

5. The relative speed of a moving object relative to an observer is :
a. equal to its real speed.
When the observer is at rest.
b. more than its real speed.
When the observer moves in the opposite direction of the movement of the object.
c. less than its real speed.
When the observer moves in the same direction of the movement of the object.
d. double its real speed.
When the observer moves in the opposite direction of the movement of the object and with the same speed.

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6. • **The relative speed of a moving body equals zero.**
   • **A moving object seems static relative to a moving observer.**
   When the observer moves in the same direction of the object and with the same speed.

7. **The acceleration of a moving body equals zero.**
   When the object moves at a regular speed.

8. **The initial speed of a moving object equals zero.**
   When the object starts its movement from the rest.

9. **The final speed of a moving object equals zero.**
   When the object moves with a decreasing acceleration until it stops.

10. **The displacement of a moving object equals zero.**
    When the object returns to its primary position of its movement (i.e. the final position of the movement is the same primary position of it).

11. • **The distance covered by an object equals the amount of displacement happened.**
    • **The amount of the speed equals the amount of the velocity.**
    When the object moves in a straight line in one direction.

8 What happens when ... ?

1. **A body moves at a uniform speed [according to the acceleration].**
   The acceleration equals zero.

2. **The initial speed of a moving body is greater than the final speed.**
   The body speed decreases by passing time and the movement is described as a decelerating motion.

3. **The object's speed changes by equal values through equal periods of time.**
   The object moves at a uniform acceleration.

4. **A car driver press the brake for stopping after a certain time.**
   The final speed of the car equals zero and the acceleration of its movement is a deceleration.

9 Comparisons :

❶ Regular speed and irregular speed :

Regular speed	Irregular speed
It is the speed by which the object moves when it covers equal distances at equal periods of time.	It is the speed by which the object moves when it covers equal distances at unequal periods of time (or unequal distances at equal periods of time).

2 Regular speed and average speed :

Points of comparison	Regular speed	Average speed
• Definition :	It is the speed by which the object moves when it covers equal distances at equal periods of time.	It is the total distance covered by the moving object divided by the total time taken to cover this distance.
• Used rule :	$(V) = \dfrac{\Delta d}{\Delta t}$	$(\overline{V}) = \dfrac{total\ (d)}{total\ (t)}$
• Measuring unit :	(m/sec.) or (km/h).	(m/sec.) or (km/h).

3 Speed and acceleration :

Points of comparison	Speed	Acceleration
• Definition :	It is the distance moved through a unit time.	It is the change of an object speed through a unit time.
• Measuring unit :	(m/sec.) or (km/h).	(m/sec^2) or (km/h^2).

4 Uniform speed and uniform acceleration :

Uniform speed	Uniform acceleration
It is the speed by which the moving object covers equal distances at equal periods of time.	It is the acceleration by which an object moves in a straight line when its speed changes by equal values through equal periods of time.

5 Positive acceleration and negative acceleration :

Positive acceleration	Negative acceleration
• It is an acceleration by which an object moves in a straight line when its speed increases by equal values through equal periods of time.	• It is an acceleration by which an object moves in a straight line when its speed decreases by equal values through equal periods of time.
• The final speed of an object > the initial speed.	• The final speed of an object < the initial speed.
• Its value is positive.	• Its value is negative.

6 Scalar physical quantity and vector physical quantity :

Points of comparison	Scalar physical quantity	Vector physical quantity
• Definition :	It is the physical quantity that has magnitude only and has no direction.	It is the physical quantity that has magnitude and direction.
• Examples :	Mass - Length - Speed - Time.	Acceleration - Force - Velocity - Displacement.

7 Distance and displacement :

Points of comparison	Distance (d)	Displacement $(\vec{d})$
• Definition :	It is the actual length of the path that a moving body covers from the starting point to the ending point.	It is the distance covered at a certain direction from the primary position of movement towards its final position.
• It is determined by :	Magnitude only.	Magnitude and direction.
• Its kind as a physical quantity :	Scalar quantity.	Vector quantity.
• Measuring unit :	Metre or kilometre.	Metre or kilometre.

8 Speed and velocity :

Points of comparison	Speed	Velocity
• Definition :	It is the distance moved through a unit time.	It is the displacement covered in one second.
• It is determined by :	Magnitude only.	Magnitude and direction.
• Its kind as a physical quantity :	Scalar quantity.	Vector quantity.
• Measuring unit :	(m/sec.) or (km/h).	(m/sec.) or (km/h).

Final Revision on Unit 2

1. Light reflection :	It is the phenomenon of the light bouncing off (returning back) in the same medium when it strikes a reflecting surface.
2. First law of light reflection :	Angle of incidence = Angle of reflection.
3. Second law of light reflection :	The incident light ray, the reflected light ray and the normal to the reflecting surface at the point of incidence all lie in one plane perpendicular to the reflecting surface.
4. The incident light ray :	It is the light ray that falls on the reflecting surface.
5. The reflected light ray :	It is the light ray that bounces (returns back) from the reflecting surface.
6. Angle of incidence :	It is the angle between the incident light ray and the normal.
7. Angle of reflection :	It is the angle between the reflected light ray and the normal.
8. Spherical mirror :	It is a mirror that its reflecting surface is a part of a hollow sphere.
9. A concave mirror (converging mirror) :	A mirror, its reflecting surface is a part of the inner surface of the sphere and converges the parallel light rays that fall on its surface.
10. A convex mirror (diverging mirror) :	A mirror, its reflecting surface is a part of the outer surface of the sphere and diverges the parallel light rays that fall on its surface.
11. Center of mirror curvature (C) :	It is the center of the sphere that the mirror is considered as a part of it.
12. Pole of the mirror (P) :	It is the point that lies in the middle of the reflecting surface of the mirror.
13. Radius of mirror curvature :	It is the radius of the sphere that the mirror is a part of it. OR It is the distance between the center of mirror curvature and any point on its reflecting surface.
14. Principal axis of the mirror :	It is the straight line that passes by the pole of the mirror (P) and its center of curvature (C).
15. Secondary axis of the mirror :	It is any straight line that passes by the center of curvature of the mirror and any point on its reflecting surface except the pole of the mirror.

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16. Focus of the mirror (F) :	It is the point of collection of the parallel rays (which are parallel to the principal axis) after being reflected from the mirror.
17. Focal length of the mirror (f) :	It is the distance between the focus of the mirror and its pole.
18. Real image :	It is the image that can be received on a screen.
19. Virtual image :	It is the image that cannot be received on a screen.
20. The lens :	It is a transparent medium that refracts the light and is limited with two spherical surfaces.
21. A convex lens "converging lens" :	- It is a transparent optical piece which is thick at its center and less thickness at the tips. - It collects light rays falling on it after refraction.
22. A concave lens "diverging lens" :	- It is a transparent optical piece which is thin at its center and more thickness at the tips. - It separates light rays after refraction.
23. The center of curvature of the lens face (C) :	It is the center of the sphere, where this face is a part of it.
24. The optical center of the lens (P) :	It is a point inside the lens that lies on the principal axis in the mid distance between its faces.
25. The radius of curvature of the face of the lens (r) :	It is half the diameter of the sphere, where this face is a part of it.
26. The principal axis of the lens :	It is the straight line that joins between the two centers of curvature of the lens passing by the optical center of the lens.
27. The secondary axis of the lens :	It is any line passes by the optical center of the lens except the principal axis.
28. The focus of the lens (F) :	It is the point of collection of the parallel light rays after refraction from the lens.
29. The focal length of the lens (f) :	It is the distance between the principal focus and optical center of the lens.
30. The virtual focus of the concave lens :	It is the point of collection of the extensions of the refracted light rays by a concave lens.
31. Short-sightedness :	It is a vision defect through which near objects can be seen clearly but far objects seem distorted.
32. Long-sightedness :	It is a vision defect through which far objects only can be seen clearly but close objects are not seen clearly.

| 33. Contact lenses : | They are very thin lenses made of plastic and can stick to the eye cornea by the eye fluid. |
| 34. Cataract disease : | It is a disease infects the eye lens, so it becomes dark. |
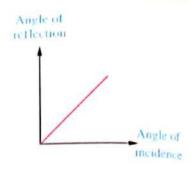
2 What is meant by...?

1. The angle of incidence on a reflecting surface is 30° :	The angle between the incident light ray and the normal equals 30°.
2. The angle of reflection is 60° :	The angle between the reflected light ray and the normal equals 60°.
3. The incident light ray on a reflecting surface, reflects on itself :	The incident light ray falls perpendicular on the reflecting surface.
4. The image formed by a plane mirror is located at 40 cm. from the body :	The body is located at 20 cm. from the plane mirror.
5. The focal length of a concave mirror is 10 cm. :	• The distance between the focus of the mirror and its pole is 10 cm. • The radius of this concave mirror is 20 cm.
6. The radius of curvature of a converging mirror is 30 cm. :	• The radius of the sphere that the mirror is a part of it is 30 cm. • The distance between the center of mirror curvature and any point on its surface is 30 cm. • The focal length of this converging mirror is 15 cm.
7. The focal length of a convex lens is 7 cm. :	The distance between the focus and the optical center of the lens is 7 cm.
8. The radius of curvature of the face of a concave lens is 10 cm. :	The half the diameter of the sphere where this face is a part of it equals 10 cm.
9. The distance between the focus and the optical center of a convex lens is 20 cm. :	This means that the focal length for this lens is 20 cm.
10. The image formed by the convex lens is real :	This means that the formed image can be received on a screen.
11. The image formed by the concave lens is virtual :	This means that the formed image cannot be received on a screen.
12. A person suffers from short-sightedness :	This means that the person sees the near objects clearly, but far objects seem distorted.
13. A person suffers from long-sightedness :	This means that the person sees the far objects only clearly, but the close objects are not seen clearly.

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3 Important laws (mathematical relations) :

1 The two laws of light reflection :

* **First law :** Angle of incidence = Angle of reflection.
* **Second law :** The incident light ray, the reflected light ray and the normal to the reflecting surface at the point of incidence all lie in one plane perpendicular to the reflecting surface.

Angle of reflection

Angle of incidence

2 In the plane mirror :

The distance between an object from the mirror = the distance between the image and the mirror.

3 In the plane mirror :

The radius of curvature of the spherical mirror (r) equals double its focal length (f).

$$r = 2 f \quad \text{or} \quad f = \frac{r}{2}$$

The diameter of the sphere = 2 r

∴ The diameter of the sphere = 4 f   i.e. focal length $(f) = \dfrac{\text{Diameter of the sphere}}{4}$

4 Importance or uses :

The item	Importance or uses
1. Concave mirror :	It is used : - In a torch to reflect light. - In front lights of cars to reflect light. - In shaving to get an enlarged and erect image of the face. - In marine lighthouses that are found at marine ports and at airports to guide ships. - In aircrafts landing at airports to guide aeroplanes. - In some types of telescopes to monitor the space and also to form an enlarged and near images of the celestial bodies. - In solar ovens to heat food, water .... etc. - By dentists to form a magnified image of the teeth at the back of the mouth cavity (molars teeth).

2. Convex mirror :	- In cars (on the right and the left sides of the driver) to form an erect and diminished image for the way behind the car. - At shopping center to allow high rate of security at these places. - On the corners of narrow roads to monitor cars movement on these narrow crossroads to avoid accidents. - At cars park to monitor cars movement at the park to avoid accidents. - At the platforms of the Metro and railway stations to avoid passenger injury at opening or closing the doors.
3. Lenses :	• They are used in many things as follows : 　- In medical eye glasses either for reading or walking. 　- The person who fixes the watches uses a magnifier lens to see 　　the minute parts of the watches. 　- In the war, the leaders use binoculars to follow the battles. 　- In making telescopes and microscopes.
4. Telescopes :	They are used for formation enlarged images for the heavenly bodies.
5. Microscopes :	They are used for formation magnified images for the tiny bodies which cannot be seen with the naked eye.
6. Concave lens :	It is used to correct the short-sightedness.
7. Convex lens :	It is used to correct the long-sightedness.
8. Contact lenses :	They are used instead of the glasses to treat the vision defects.

5 Give reasons for :

1. **When you look at a mirror, you see your face image.**
   Due to light reflection.

2. **• The perpendicular incident light ray on a plane mirror reflects on itself.**
   • The incident light ray falling perpendicular on a reflecting surface, reflects on itself.
   Because the angle of incidence equals the angle of reflection equals zero.

3. **The image formed by a plane mirror is virtual.**
   Because it cannot be received on a screen.

4. **The word AMBULANCE is written in a laterally inverted way on the ambulance car.**
   Because the mirrors of the cars in front of the ambulance car, form a laterally inverted image for this word, and thus it appears laterally corrected to the drivers.

5. **• When you look at a plane mirror, you find that you hold the pen by the left hand which is inverse the real position.**
   • Most of people can't write by a correct way, while they are seeing their writings through a plane mirror.
   Because the images formed by the plane mirror are laterally inverted (reversed).

6. **The spoon which is made of silver is a spherical mirror.**
   Because its inner surface is a concave mirror, while its outer surface is a convex mirror.

7. **The convex mirror is called diverging mirror, while the concave mirror is called converging mirror.**

   Because convex mirror diverges the parallel light rays after reflection, while concave mirror converges (collects) the parallel light rays after reflection.

8. **The spherical mirror has only one principal axis and uncountable number of secondary axes.**

   It has one principal axis, because it has one center of curvature and one pole, while it has uncountable number of secondary axes, because any straight line passes by its center of curvature and any point on the reflecting surface of the mirror except its pole, is considered as a secondary axis.

9. **The focal length of a spherical mirror can be determined by knowing its radius of curvature.**

   Because focal length (f) = $\frac{1}{2}$ × radius of curvature (r).

10. **The focus is virtual by the convex mirror.**

    Because it is produced due to the collection of the extensions of the reflected light rays.

11. **Concave mirror is used to generate high heat energy.**

    Because the concave mirror collects the reflected light rays falling on it in one point (focus) generating high heat energy.

12. **The incident light ray on a concave mirror passing through the center of curvature reflects on itself.**

    Because it falls perpendicular to the spherical mirror so, its incidence angle equals its reflection angle equals zero.

13. **To obtain a suitable image for you, you should stand at a distance less than the focal length of a concave mirror.**

    Because the formed image will be virtual, upright and magnified.

14. **The image formed by the convex mirror cannot be received on a screen.**

    Because it is a virtual image.

15. **The image formed by a convex mirror is always virtual.**

    Because it is formed behind the mirror from the intersection of the extensions of the reflected light rays and it can't be received on a screen.

16. **A convex mirror is put at the left side of the driver of the car.**

    Because it forms an erect and smaller image for the way behind the car.

17. **The real image can be received on a screen, while virtual image cannot.**

    Because real image is formed in front of the mirror from intersection of the reflected light rays, while virtual image is formed behind the mirror from the intersection of the extensions of the reflected rays.

18. **The convex lens is called converging lens, while the concave lens is called diverging lens.**

    - The convex lens is called converging lens : because it refracts the rays towards the principal axis, so it collects light rays falling on it.
    - The concave lens is called diverging lens : because it refracts the rays away from the principal axis, so it separates light rays falling on it.

19. **The focal length of the thick convex lens is less than that of the thin convex lens.**

Because the radius of the thin lens is bigger than that of the thick lens.

20. **Lenses have two centers of curvature.**

Because they have two circular surfaces, each surface has a center.

21. **The collective lens has two foci, but the collective mirror has one focus.**

Because the convex lens has two circular surfaces, but the concave mirror has one circular surface.

22. **No image is formed when the object is placed at the focus of a convex lens.**

Because the penetrating rays from a lens don't meet and pass through a parallel way at infinity.

23. **The convex lens is used for burning paper with sun rays.**

Because convex lens collects and concentrate the sunlight in a point which is burned.

24. **The image formed by the concave lens cannot be received on the screen.**

Because it is a virtual image formed as a result of the intersection of the extensions of the refracted light rays.

25. **It is impossible to obtain a real image by using a concave lens.**

Because the real image is formed as a result of the intersection of the refracted light rays but the concave lens forms an image as a result of the intersection of the extensions of the refracted light rays which is called virtual image.

26. **The image formed by the convex lens can be received on the screen.**

Because it is a real image formed as a result of intersection of the refracted light rays.

27. **Vision defects occur .**

Because the eye lens is not always convex or the eye is not always spherical.

28. **Short-sighted person sees the far objects distorted.**

Because the images of these objects do not fall on the retina of the eye, but in front of it.

29. **Some persons have short-sightedness.**

Due to : - The increase in the eyeball diameter.
- The increase in convexity of the eye lens surface.

30. **The person who is infected by short-sightedness, the retina is far from the eye lens.**

Due to the increase in the eyeball diameter.

31. **Concave lens is used to treat short-sighted person.**

Because the concave lens diverges the rays coming from a far object, so the image is formed on the retina.

32. **Some persons have long-sightedness.**

Due to : - The decrease of the eyeball diameter.
- The decrease in convexity of the eye lens surface.

33. **Long-sighted person cannot see the close objects clearly.**

Because the images of the close objects don't fall on the retina, but behind it.

34. **The retina is close to the eye lens in long-sighted person.**

Due to the decrease of the eyeball diameter.

35. **The near objects are collected behind the eye retina in long-sightedness.**

Due to the decrease of convexity of the eye surface which results more focal length, so the rays coming from the near object are collected in a point behind the eye retina.

36. **Long-sightedness is treated by using a convex lens.**

Because the convex lens collects the rays, so the image of the object is formed on the retina.

37. **The infection of the eye with the cataract.**

Due to the following reasons :

- Old age.
- Illness.
- Side effects of drugs.
- Genetic readinese.

6 What happens when ... ?

1. **The angle of incidence of a light ray increases from 20° to 50°.**

The angle of reflection of the light ray increases from 20° to 50°.

2. **A light ray falls perpendicular to a plane mirror.**

It reflects on itself.

3. **A light ray is incident by an angle 45° on a plane mirror.**

It reflects by an angle equals 45°.

4. **The body becomes closer to the mirror [concerning the distance between the image and the plane mirror].**

When the body move close to the mirror, the image will move close to the mirror also to make the distance between the image and the mirror = the distance between the object and the mirror.

5. **A light ray is incident on a concave mirror passing through its focus.**

It reflects parallel to the principal axis.

6. **Incidence of a light ray parallel to the principal axis of a concave mirror.**

It reflects passing through the focus.

7. **A light ray falls on a concave mirror passing through its center of curvature.**

It reflects on itself.

8. **A body is placed at the double of focal length of the concave mirror.**

A real, inverted and equal image is formed at the center of curvature.

9. **A plane mirror is put at the left side of the driver of the car instead of a convex mirror.**

An equal image for the way is formed, so the driver doesn't see the way.

10. **An object is put between the focus and the center of curvature of a concave mirror.**

A real, inverted and enlarged image is formed after the center of curvature.

11. **An object is put in front of a concave mirror at a distance less than the focal length.**

A virtual, erect and magnified image is formed behind the mirror.

12. **The radius of curvature of the face of the lens increases twice (concerning the focal length).**

∵ The focal length (f) $= \frac{1}{2}$ radius (r)   ∴ The focal length also increases twice.

13. **You move a screen closed and farther from a convex lens, when its other side is facing to a light source.**

The rays after being refracted collect in one lit point is called the focus of the lens that can be received on the screen.

14. **Concentrating sunlight by a magnifying lens on a piece of paper.**

The piece of paper is burned.

15. **A light ray passes through the focus of a convex lens.**

It exits from the lens parallel to the principal axis.

16. **A light ray passes through the optical center of the lens.**

It passes through the lens without refraction.

17. **A light ray is incident parallel to the principal axis of the convex lens.**

It refracts passing through the focus.

18. • **An object is put at the focus of a convex lens.**

 • **An object is put at the focus of a concave mirror.**

   No image is formed.

19. **An object is put in front of a convex lens at a distance greater than the focal length, but less than the double of the focal length.**

A real, inverted and magnified image is formed after the center of curvature.

20. **We want to see a virtual, erect and magnified image of an object through a convex lens.**

We must put the object at a distance less than the focal length.

21. **Incidence of a beam of light rays parallel to the principal axis of a concave lens.**

The parallel rays pass through the concave lens and are diverged and their extensions are collected in a virtual focus of the lens.

22. **An object is put in front of a concave lens.**

A virtual, erect and small image is formed before the object in the same side.

23. **The eye lens surface in man is too convex.**

He can see near objects clearly but far objects seem distorted.

24. **The diameter of the eyeball becomes longer than a certain length.**

This causes the retina to be far from the eye lens and this causes short-sightedness.

25. • **The eyeball diameter decreases.**

 • **The shortness of the radius of the eyeball.**

   This causes the shortness of the radius of the eye sphere, thus the retina is close to the eye lens and this causes long-sightedness.

26. The eye lens surface in man is less convex.

He can see far objects only clearly but close objects are not seen clearly.

27. The eye infected by cataract.

The vision becomes difficult as a result of the darkness of the eye lens.

7 Comparisons :

❶ Concave mirror and convex mirror :

Concave mirror (converging mirror)	Convex mirror (diverging mirror)
- A mirror, its reflecting surface is a part of the inner surface of the sphere. - It converges (collects) light rays after reflection. - Its focus is real.	- A mirror, its reflecting surface is a part of the outer surface of the sphere. - It diverges light rays after reflection. - Its focus is virtual.

❷ Concave mirror and plane mirror :

P.O.C.	Concave mirror	Plane mirror
- The shape :		
- Formation :	Its reflecting surface is the inner part of a hollow sphere.	It is made of a piece of plane glass painted from behind with a thin layer of shiny (silver) metal.
- The properties of the formed image :	• Real except if the object is put at a distance less than the focal length , it will be virtual. • Inverted except if the object is put at a distance less than focal length, it will be erect. • The size depends on the distance between the object and the mirror.	• Always virtual. • Always erect. • Always equal to the size of object.

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❸ Principal axis and secondary axis of the mirror :

Principal axis of the mirror	Secondary axis of the mirror
- It is the straight line that passes by the pole of the mirror (P) and its center of curvature (C). - There is only one principal axis for the mirror.	- It is any straight line that passes by the center of curvature of the mirror and any point on its surface except the pole of the mirror. - There are uncountable number of secondary axes for the mirror.

❹ Concave lens and convex lens :

Concave lens	Convex lens
- It is thin at its center and more thick at the tips. - It separates light rays, so it is called "diverging lens". - Its focus is virtual.	- It is thick at its center and less thick at the tips. - It collects light rays falling on it, so it is called "converging lens". - Its focus is real.

❺ Principal axis and secondary axis of the lens :

Principal axis of the lens	Secondary axis of the lens
It is the straight line that joins between the two centers of curvature of the lens passing by the optical center of the lens.	It is any line passes by the optical center of the lens except the principal axis.

❻ Principal axis of the mirror and principal axis of the lens :

Principal axis of the mirror	Principal axis of the lens
It is the straight line that passes by the pole of the mirror and its center of curvature.	It is the straight line that joins between the two centers of curvature of the lens passing by the optical center of the lens.

❼ Focus of the concave mirror and focus of the convex mirror :

Focus of the concave mirror	Focus of the convex mirror
1. It is a real focus. 2. It is the point of collection of the reflected light rays. 3. It is located in front of the concave mirror.	1. It is a virtual focus. 2. It is the point of collection of the extensions of the reflected light rays. 3. It is located in the back of the convex mirror.

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8 Focus of the mirror and focus of the lens :

Focus of the mirror	Focus of the lens
It is the point of collection of the parallel rays (which are parallel to the principal axis) after being reflected from the mirror.	It is the point of collection of the parallel light rays after their refraction from the lens.

9 Real image and virtual image :

The real image	The virtual image
1. It can be received on a screen.	1. It cannot be received on a screen.
2. It is formed as a result of the intersection of the reflected (or refracted) light rays.	2. It is formed as a result of the intersection of the extensions of the reflected (or refracted) light rays.
3. It is formed in front of the mirror.	3. It is formed behind the mirror.
4. It is always inverted.	4. It is always erect.
5. It is formed in the case of using of : • Concave mirror. [It is diminished, magnified or equal to the object according to the position of the object from the mirror].	5. It is formed in the case of using of : • Concave mirror. [when the object is at a distance less than the focal length, and it is magnified] • Convex mirror. [when the object is at any distance of the mirror, and it is diminished] • Plane mirror. [when the object is at any distance of the mirror, and it is equal to the object]

10 Short-sightedness and long-sightedness :

Points of comparison	Short-sightedness	Long-sightedness
• The images of near (close) objects :	Can be seen clearly.	Cannot be seen clearly.
• The images of far objects :	Cannot be seen clearly.	Can be seen clearly.
• The position of the images concerning the retina :	In front of the retina.	Behind the retina.
• Causes :	- The increase in the eyeball diameter. OR - The increase in the convexity of the eye lens surface.	- The decrease in the eyeball diameter. OR - The decrease in the convexity of the eye lens surface.
• The correction :	By using a concave lens.	By using a convex lens.

8 Important drawings :
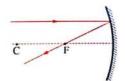
1 Spherical mirrors :

① Convex mirror.

② Concave mirror.

③ The principal axis of the mirror.

④ The radius of mirror curvature.

⑤ The focal length of the convex mirror.

⑥ The pole of concave mirror (P).

⑦ Center of mirror curvature (C).

⑧ & ⑨ Secondary axis of the mirror.
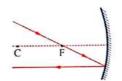
2 The path of some incident rays on a concave mirror and their reflections :

A	B	C
The incident ray which is parallel to the principal axis reflects passing through the focus.	The incident ray which passes through the focus reflects parallel to the principal axis.	The incident ray which passes through the center of curvature reflects on itself.
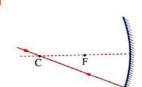
3 The formation of images by the concave mirror :

The position of the object from the mirror	The position of the image from the mirror	Shape of the rays path	The properties of the formed image
(1) Very far [The incident rays are parallel].	At the focus		- Real. - Very tiny (dot).
(2) At a distance greater than the radius of curvature. [After the center of curvature]	At a distance greater than the focal length, but less than the double of focal length [Between the focus (F) and the center of curvature (C)]		- Real. - Inverted. - Diminished [smaller than the object].

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(3) At a distance equals the radius of curvature [At the center of curvature (C)].	At the center of curvature (C)		- Real. - Inverted. - Equal to the object.
(4) At a distance greater than the focal length, but less than the radius of curvature [Between the focus (F) and the center of curvature (C)].	After the center of curvature. [At a distance greater than the radius of curvature]		– Real. – Inverted. – Magnified. [larger than the object].
(5) At the focus.	No image is formed.		
(6) At a distance less than the focal length [Between the focus (F) and the pole (P)].	Behind the mirror.		– Virtual. – Erect. – Magnified.

4 **The formation of images by the convex mirror :**

* **The position of the object :**

At any position in front of the convex mirror.
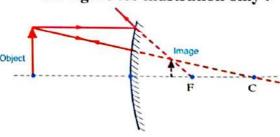
* **The position of the image :**

The image is formed behind the mirror.

* **The properties of the formed image always is :**

- Virtual.   - Erect.   - Diminished.

The figure for illustration only :

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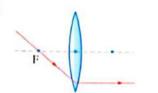
5 **The path of some incident rays on a convex lens face and their emergencies from it :**
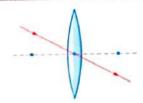
A

The incident ray which is parallel to the principal axis refracts passing through the focus.

B

The incident ray which passes through the focus refracts parallel to the principal axis.

C

The incident ray which passes through the optical center of the lens does not refract and passes in a straight line.

6 **The formation of images by the convex lenses :**

The position of the object from the lens	The position of the image from the lens	Shape of the rays path	The properties of the formed image
(1) Very far [the incident rays are parallel].	At the focus		– Real. – Very tiny [dot].
(2) At a distance greater than the double of focal length. [After the center of curvature].	Between the focus and the center of curvature.		– Real. – Inverted. – Diminished [smaller than the object].
(3) At a distance equal to the radius of curvature [At the center of curvature (C)].	At the center of curvature (C).		– Real. – Inverted. – Equal to the object.
(4) At a distance greater than the focal length, but less than the radius of curvature [Between the focus (F) and the center of curvature (C)].	After the center of curvature.		– Real. – Inverted. – Magnified. [larger than the object].
(5) At the focus.	No image is formed.		

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(6) At a distance less than the focal length [Before the focus].	The image is formed farther than the object position [according to the lens], and in its same direction.		– Virtual. – Erect. – Magnified.

7 The formation of images by the concave lens :

* **The position of the object :**

At any distance from the concave lens.

* **The position of the image :**

The image is formed nearer to the object position (according to the lens), and in its same direction.

* **The properties of the formed image always is :**

- Virtual.   - Erect.   - Diminished.
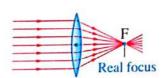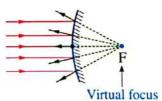
8 Real focus in concave mirror :

Real focus

9 Virtual focus in convex mirror :

Virtual focus
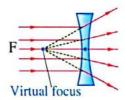
10 Real focus in convex lens :

Real focus

11 Virtual focus in concave lens :

Virtual focus

9 **Activities :**
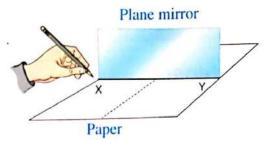
Activity **1** To discover the two laws of light reflection :

Materials :

• A plane mirror.   • White paper sheet.   • Pins.
• Protractor.   • Ruler.

▶ *Steps :*
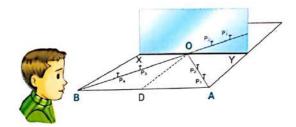
1. Draw a straight line (XY) on the white paper, then fix the plane mirror in a perpendicular position where the edge of the reflective surface aligns on the line (XY).

2. Draw a line (OD) [which represents the normal] perpendicular on the line (XY).

3. Draw a straight line (AO) [which represents the incident light ray on the mirror] which make an angle with the normal (angle of incidence) then place two pins (P₁) and (P₂) horizontal on the line.

4. Look at the other side of the mirror and see the images of the pins (P₁) and (P₂) , then place two pins (P₃) and (P₄) to be at a straight line with (P₁) and (P₂).

5. • Lift the two pins (P₃) and (P₄) and connect between their positions with a straight line.
   • Extend the line to meet the reflecting surface at point (O).
   • This line (BO) represents the reflected light ray.

6. Measure the angle that (BO) makes with the normal, and this is the angle of reflection (Using the protractor).

7. Repeat these steps by changing the value of the incidence angle by using the protractor and assign each time the angle of reflection.

8. Record your results in a table as shown.
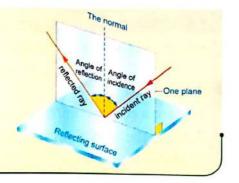
Angle of incidence	Angle of reflection
....	....
....	....
....	....

▶ *Observation :*

- The angle of incidence = The angle of reflection.

▶ *Conclusion :*

- **Reflection of light is governed by two laws :**
* **First law :** Angle of incidence = Angle of reflection.
* **Second law :** The incident light ray, the reflected light ray and the normal to the reflecting surface at the point of incidence all lie in one plane perpendicular to the reflecting surface.
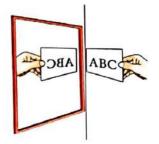
Activity (2) To discover the properties of the image formed by the plane mirror :

Materials :

• A plane mirror.

• A card with some letters written on it.

Steps :

1. Place the card in front of the mirror that is fixed vertically.

2. Record your observation about the properties of the image formed on the plane mirror.

Observation & Conclusion :

The properties of the image formed by a plane mirror :

1. The image is upright (erect).

2. The image is equal to the object in size.

3. The image is laterally inverted (reversed).

4. The image is virtual (cannot be received on a screen).

5. The distance between the object and the mirror is equal to the distance between the image and the mirror.

6. The straight line joining the object to its image is perpendicular to the surface of the mirror.

Activity (3) The focus length of the concave mirror :

Materials :

• A concave mirror.

• A screen.

• A far light source (as the Sun).

Steps :

1. Place a concave mirror facing the Sun rays (parallel light rays).
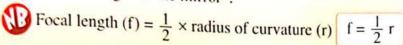
2. Move the screen in front of the reflecting surface of the mirror to obtain the smallest and clearest image.

3. Measure the distance between the lit point and the pole of the mirror.

▶ *Observation :*

The parallel light rays coming from the Sun are reflected and collected in a lit point (smallest and clearest image).

▶ *Conclusion :*

1. The point of collection of the parallel rays after being reflected from the concave mirror is called "The focus of the mirror".

2. The distance between the focus of the concave mirror and its pole is called "The focal length of the mirror".

NB Focal length (f) = $\frac{1}{2}$ × radius of curvature (r) $\boxed{f = \frac{1}{2} r}$

Activity (4) The radius of the mirror curvature :

▶ *Materials :*

• A concave mirror.

• A holder for the mirror.

• A light box with a hole.

• A ruler.

A light box

A hole

Image

A concave mirror

The holder

▶ *Steps :*

1. Place the mirror on the holder in front of the light source (the light box which has a hole).

2. Move the mirror nearer and farther until an image of the hole is formed next to it and is equal to it.

3. Measure the distance between the mirror and the formed image of the hole.

▶ *Observation & Conclusion :*

1. The position of the formed image of the hole is called "the center of the mirror curvature"

2. The distance between the mirror and the formed image of the hole is called "the radius of the mirror curvature".

Radius of mirror curvature (r) = 2 f   ∴ The focal length of the mirror (f) = $\frac{r}{2}$

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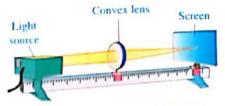
Activity ⑤ The focus and the focal length of the convex lens :

▶ Materials :

- A convex lens.
- A light source.
- A screen.

Convex lens Screen

Light source

The convex lens froms a real, inverted smaller (tiny) image of the distant object

Steps :	Observations
1. Fix the lens, where the light source is facing one of its faces.	
2. Move the screen closed and farther from the other side of the lens until you get the lit point.	The rays after being refracted collect in one lit point is called the focus of the lens that can be received on the screen.
3. Measure the distance between the lit point and the optical center of the lens.	

▶ Conclusion :

1. The convex lens is a converging lens as it collects the refracted rays.

2. The point of collection of the parallel rays (produced from the Sun or any distant object) after being refracted from the convex lens is called "the focus of the lens (F)".

3. The distance between the focus of the lens and its optical center is called "the focal length of the lens (f)".

4. The focal length (f) = $\frac{1}{2}$ × radius of curvature (r) $\boxed{f = \frac{1}{2} r}$

Final Revision on Unit 3

1 Definitions (or scientific terms) :

1. The universe :	It is the wide and extended space that contains all the galaxies, stars, planets, moons, living organisms and everything.
2. Galaxies :	* They are groups of stars that rotate together in cosmic space by the effect of gravity. **OR** * They are the greatest units that form the universe.
3. Galaxies clusters :	They are groups of galaxies that rotate together in cosmic space by the effect of gravity.
4. The solar system :	It contains the Sun and eight planets revolving around the Sun.
5. Light year :	It is the distance covered with light in one year and it equals 9.46×10^{12} km.
6. Expansion of the universe :	It is the continuous separation between galaxies in the space as a result of their regular movement.
7. Big Bang :	It is a theory that explains the origin of the universe from a massive explosion since 15000 million years and resulted in it all forms of matter, energy, time and space followed by continuous expansion and changing processes.
8. Nebula :	It is a glowing gaseous sphere revolving around itself, from which the solar system was originated.
9. The force of gravity :	It is the force that keeps the continuity of the planets rotation in their orbits around the Sun.
10. Stars explosion phenomenon :	Glowing of a star for a short time to become one of the most shining stars in the sky, then its glowing disappears gradually to return as it was.

2 Important numbers :

1. The number of galaxies in the universe.	**100000 million galaxies.**
2. The time that the Sun takes to complete one rotation around the centre of the galaxy.	**220 million years.**
3. Light year.	9.46×10^{12} km.
4. Number of planets of the solar system.	**8 planets.**
5. Number of stars in the solar system.	**one star.**
6. Age of the universe since Big Bang.	**15000 million years.**
7. The height of Hubble telescope from the Earth's surface.	**500 km.**

3 Importance or use :

Item	Importance or use
1. Solar telescope :	It forms a complete picture for the Sun.
2. Hubble telescope :	It collects photos for the universe that give us details about its state since millions of years, these photos give astronomers an opportunity to study the evolution of the universe after the Big Bang.

4 Give reasons for :

1. **Our galaxy is called Milky Way galaxy.**

   Because it appears in the sky at night as a splashing milk or spreading straw.

2. • **The difference in the shapes of galaxies that form the universe.**

   • **Each galaxy in the universe has a distinctive shape.**

   Because each galaxy has a distinctive shape according to the harmony and order of the groups of stars in it.

3. • **Astronomers don't measure the distances between stars in kilometres.**

   • **The distances in the universe are measured in light year.**

   Because the distances between stars are very large.

4. **Galaxies move away from each other.**

   As a result of their regular movement.

5. **The continuous expansion of the cosmic space.**

   Due to the movement of galaxies apart.

6. • **Planets revolve around the Sun in fixed orbits.**

   • **The stability of the Earth rotation in an orbit around the Sun.**

   Due to the Sun gravity.

7. • **Separation of parts of nebula and formation of gaseous rings rotate in the same direction in which the nebula rotates.**

   • **The nebula lost its sphere form and became in a form of a flat rotating disk.**

   Due to the effect of centrifugal force that is resulted from the rotation of the nebula around itself.

8. **Explosion of some stars suddenly.**

   Due to occurrence of sudden and violent nuclear reactions.

9. **The Sun escaped from the gravity of the huge star in the crossing star theory.**

   Due to the explosion in the expanded part of the Sun that faces the huge star.

5 What are the results based on ... ?

1. • Galaxies move away from each other as time passes.
   • Separation (distances) of galaxies.
   The universe is in a state of continuous expansion.

2. Gathering of stars together in the universe.
   Galaxies are formed.

3. The merge of the atomic particles together within minutes of the Big Bang.
   Formation of gaseous clouds of hydrogen and helium gases with a percentage of 75% : 25% respectively which produced the galaxies, stars and universe over millions of years.

4. Occurrence of Big Bang.
   The origin of the universe with all its forms of matter, energy, time and space.

5. The nebula lost its temperature in Laplace's opinion.
   Its size contracted and its revolving speed around itself increased.

6. Explosion of the expanded part from the Sun in crossing star theory.
   The Sun escaped from the gravity of the crossing star and a gaseous line was formed from the Sun until the last planets.

7. The explosion of the star nearer to the Sun according to Fred Hoyle.
   The bombing of the star's nucleus away from the gravity of the Sun and a gaseous cloud from this star remained around the Sun.

8. Approaching of a huge star to the Sun according to the crossing star theory.
   The star attracted the Sun to it which led to a great expansion in the part of the Sun facing it.

9. The gaseous cloud is cooled in the Fred Hoyle theory about the evolution of the solar system.
   It contracts and forms the planets.

6 What happens ... ?

1. When the distance between the planet and the Sun increases.
   The gravity between them decreases and the movement of the planet around the Sun becomes slower.

2. If the gravity between the Sun and planets which rotate around is vanished.
   The planets will leave their orbits and float in a random fashion in the cosmic space and therefore there will be no solar system.

3. If the organization and arrangements of the groups of stars in galaxy were changed.
   The shape of galaxy is changed.

7 Important table :

* **Stages of the origin of the universe since Big Bang :**

Through Big Bang :	The gaseous ball from which the universe originated exploded and the process of expansion and changing started.
Within minutes after the explosion :	- The temperature decreased to about 10 000 million degrees. - The atomic particles produced from explosion merged together producing gaseous clouds of **hydrogen** and **helium** with a percentage of **75% : 25%** respectively. - These gases produce galaxies, stars and universe through millions of years.
After about 1000 million years :	The previously formed matter merged in the form of **masses**.
After about 2000 : 3000 million years :	The gravity helped in gathering of more masses forming (**Ancestral galaxies**) leaving areas of empty space between them.
After about 3000 million years :	Galaxies began to form.
After about 5000 million years :	Our galaxy, the Milky Way took its disc form.
After about 10 000 million years :	- The Sun was born. - Then the Earth and planets were created.
After about 12000 million years :	Earliest life forms began to appear on the Earth.
After about 15000 million years :	The universe is as it is now.

8 Important theories :

❶ **Big Bang theory:**

The Big Bang theory assumed that :

- The beginning of the universe was a gaseous ball of high pressure, high temperature and small in volume.
- A massive explosion occurs to this ball since 15000 million years and its components were scattered in space followed by continuous expansion and changing processes till now.
- Resulted from this explosion, all forms of matter, energy, space and time.

2 Nebular theory about the evolution of the solar system (Laplace 1796) :

• **Assumptions of nebular theory :**

It assumed that the origin of the solar system was the nebula.

1. **The contraction of nebula :**
   • The solar system originated from a glowing gaseous sphere revolving around itself, this sphere is called "Nebula".
   • By passing time, the nebula lost its heat gradually, so its size contracted and its revolving speed around itself (axis) increased.

2. **Formation of the gaseous rings :**
   The centrifugal force arising from the rotation of nebula around its axis led to :
   • The nebula lost its spherical form and became in a form of a flat rotating disk.
   • Separation of parts of nebula in the form of gaseous rings that also rotate around the remaining flaming mass from it and in the same direction.

3. **Formation of the solar system :**
   • The gaseous rings cooled down and frozen forming the planets of the solar system.
   • The flaming mass that is remained in the centre formed the "Sun".

3 The crossing star theory about the evolution of the solar system (Chamberlain and Moulton 1905) :

• **Assumptions of the crossing star theory :**

It assumed that the origin of the solar system was the Sun.

1. Another huge star (crossing star) approached to the Sun.
2. This star attracted the Sun to it which led to a great expansion in the part of the Sun facing this star.
3. **The expanded part from the Sun was exploded which led to :**
   • The Sun escaped from the gravity of that star.
   • A gaseous line was formed of a great length from the Sun to the last planets.
4. The gaseous line started to condense due to the attraction force, then it cooled forming the planets.

4 The modern theory about the evolution of the solar system (Fred Hoyle 1944) :

• **Assumptions of the modern theory :**

It assumed that the origin of the solar system was a star rather than the Sun.

1. A star was rotating near the Sun.
2. The star exploded due to huge nuclear reactions.
3. **The force of the explosion led to :**
   • The bombing of the star's nucleus away from the gravity of the Sun.
   • A gaseous cloud from this star remained around the Sun.
4. The gaseous cloud subjected to cooling and contraction processes forming the matter of planets, then the attraction force of the Sun controlled the orbits of planets around it.

9 Comparison :

- **Nebular theory, Crossing Star theory and Modern theory :**

Points of comparison	Nebular theory	Crossing star theory	Modern theory
• The founder :	Laplace	Chamberlain and Moulton	Fred Hoyle
• The origin of the solar system :	A glowing gaseous sphere revolving around itself. (Nebula)	The Sun.	A star rather than the Sun.
• The force that causes the formation of the solar system :	The centrifugal force arising from the rotation of nebula around its axis.	The force of attraction of the crossing star and the force of explosion of the expanded part from the Sun.	The force of explosion of the huge star resulting from the occurrence of sudden and violent nuclear reactions within it.

10 Activity :
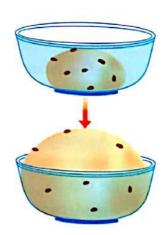
Activity Expansion of the universe and separation (or distances) of galaxies :

▶ **Tools :**

Warm water - Flour - Raisins - Bread yeast - Glass container.

▶ **Steps :**

- Mix some flour and some of bread yeast with warm water well in the glass container to make bread dough (which represents the universe).
- Insert some raisins (which represents the galaxies) on the surface of the dough.
- Leave the dough to ferment in a warm environment.

▶ **Observation :**

When the dough expands, raisins become apart from each other.

▶ **Conclusion :**

The universe is in continuous expansion.

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1 Definitions (or scientific terms) :

1. Chromosomes :	* They are thread like bodies present in cell's nuclei and they represent the genetic material of the living organism. * They chemically consist of a nuclear acid (DNA) and protein.
2. Centromere :	It is the point of connection of the two chromatids of chromosome.
3. DNA :	It is the nuclear acid that carries the genetic traits of the living organism.
4. Mitosis (mitotic cell division) :	It is a kind of cell division that occurs in somatic cells, at which the cell divides into two new cells, each of them contains the same number of chromosomes of the parent cell.
5. Somatic cells :	They are all body cells except the reproductive cells, they divide by mitotic division and they contain a diploid number of chromosomes.
6. Interphase :	It is the phase which is occurred before starting the cell division process, at which the cell prepares for division by the occurrence of some important biological processes and the duplicate of genetic material (DNA).
7. Spindle fibers :	Fibers extend between the two poles of the cell in prophase.
8. Meiosis (meiotic cell division) :	It is a kind of cell division that occurs in the reproductive cells, at which the cell divides into four new cells (gametes), each cell contains half the number of chromosomes of the parent cell.
9. Reproductive cells :	They are the cells of the reproductive system, they divide by meiotic division and they contain a diploid number of chromosomes.
10. Tetrad :	They are the arrangement of homologous pairs of chromosomes where each pair consists of 4 chromatids.
11. Crossing over phenomenon :	It is a phenomenon that takes place at the end of prophase I and, in which some parts of the two inner chromatids of each tetrad are exchanged to produce new genetic arrangements.
12. Cancer :	A dangerous disease occurs when the body cells are divided continuously with out controlling.
13. Tumor :	A mass of cells that produced due to the abnormal continuous division of cells.

14. Reproduction :	It is a biological process, where the living organism produces new individuals of the same kind and thus, ensuring its continuity.
15. Asexual reproduction :	* It is a process by which a living organism produces new individuals with genetic traits identical to those of their parent. * It is a kind of reproduction that involves only one parent.
16. Reproduction by binary fission :	It is a type of asexual reproduction where the nucleus divides mitotically, then the cell splits into two identical cells.
17. Reproduction by budding :	It is a type of asexual reproduction that produces new individuals by formation of buds in the parent cell.
18. Bud :	It is a structure emerges as a lateral bulge from the mother's cell and contains a nucleus.
19. Regeneration :	It is the ability of animals to compensate their missing parts.
20. Reproduction by regeneration :	It is the ability of the missing part from some living organisms to grow forming a complete organism identical to the parent individual.
21. Reproduction by spore propagation :	It is a type of asexual reproduction that occurs in some fungi and algae by producing spores.
22. Sporongia :	They are special organs that are found inside them a large number of spores.
23. Vegetative reproduction :	It is a type of asexual reproduction that takes place in plants' vegetative organs without the need of seeds.
24. Sexual reproduction :	* It is a process in which living organisms produce new individuals with genetic traits differ from those of their parents. * It is a kind of reproduction that involves two living organisms, one of them is a male and the other is a female.
25. Fertilization :	It is the combination of a male gamete (N) and a female gamete (N) to form a zygote (2N).
26. Zygote :	It is a cell produced due to fertilization and it contains the complete number of chromosomes of the living organism.

2 Importance :

1. Chromosomes :	• They represent the genetic material of the living organism. • They play an important role in the cell division. • Knowing the number of chromosomes helps in identifying the animal and plant species.
2. Centromere :	It is the point of connection of the two chromatids of chromosome.
3. DNA :	It carries the genes that carry the genetic traits of the living organism.
4. Mitosis :	It plays an important role in : - compensation of the damaged cells. - growth of living organisms (animals and plants). - completing the asexual reproduction process.
5. Interphase :	**It prepares the cell for division by :** • The occurrence of some important biological processes. • The duplicate of the genetic material (DNA).
6. Spindle fibers :	They pull the chromatids to one of the cell poles in anaphase to form two identical groups of chromosomes.
7. Meiosis :	Production of male gametes and female gametes to complete the sexual reproduction.
8. Crossing over phenomenon :	It works on the variation of genetic traits among the members of the same species, where it contributes in genes exchanging between the two homologous chromosome's chromatids and distributing them randomly in the gametes.
9. First meiotic division :	It produces two cells, each of them contains half number of chromosomes.
10. Second meiotic division :	It aims to increase the number of the produced cells from the first meiotic division.
11. Nano-molecules of gold :	Treating of cancer.
12. Proteins that are loaded on gold molecules :	Attach (adhere) to the cancerous cell to monitor it.
13. Laser in treating cancer by nanotechnology :	Burning and killing the infected cell.

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14. Meiosis in keeping the number of chromosomes constant in the same species :	At fertilization, the male gamete (N) combines with the female gamete (N) to form zygote which contains full number of chromosomes (2N), it thus maintains the members of the same species.
15. Reproduction :	It produces new individuals of the same kind and preserve them from extinction.
16. The asexual reproduction in producing offspring identical to their parents :	The new offspring gets full copy of the parental individual genetic traits, so there are no genetic changes.
17. The sexual reproduction in the occurrence of the genetic variation :	The resulted offspring have new genetic traits different from parent's traits, so sexual reproduction is a source of genetic variation.

3 Give reasons for :

1. **Chromosomes are considered as the genetic material for the cell.**

   Because they contain the genes that carry the genetic traits of the living organism.

2. **The cell nucleus is the part of the cell responsible for cell division.**

   Because it contains the genetic material of the living organism which consists of a number of chromosomes that have the main role in cell division.

3. • **The cell undergoes an interphase before cell division.**

   • **Cellular division begins with interphase.**

   To prepare the cell for division through some important biological processes where the amount of genetic material duplicates.

4. **Duplicating the genetic material in the interphase for cell division.**

   To obtain each cell from the cells resulting from division on a complete copy of genetic material.

5. **The difference in the way of formation of spindle fibers in plant cell than in animal cell.**

   Because in the plant cell, the spindle fibers are formed from condensing the cytoplasm at the cell poles, while in the animal cell, they are formed by the centromere.

6. **Shrinking of spindle fibers during anaphase of mitosis division.**

   To form two identical groups of chromosomes at each pole of the cell.

7. **The changes that occur in telophase of mitotic division are called adverse changes.**

Because they inverse the changes that occur in prophase.

8. **The damaged nerve cells can't be compensated.**

Because nerve cells don't divide at all.

9. **Meiotic division is called by reduction division.**

Because the produced cells contain half the number of chromosomes of the original cell.

10. **The gametes are often (N) , while somatic cells are often (2N).**

Because gametes produced by meiosis division , while somatic cells produced by mitosis division.

11. **Meiosis is considered the source of genetic variation on which the variation of living organisms depends on.**

Due to the occurrence of the crossing over phenomenon during it.

12. **. Crossing over plays an important role in meiosis.**

   • **Crossing over is the source of genetic variation between members of the same species.**

Because it contributes in genes exchanging between the two homologous chromosome's chromatids and distributing them randomly in the gametes.

13. **The mitotic division is important for children than meiosis.**

Because mitosis division plays an important role in growth which the body of children needs, while meiosis division aims to the production of gametes in adults only.

14. **Nanotechnology is called by this name.**

Because in which, very small molecules are used which their lengths are measured by nanometer unit.

15. **Laser is used for the treatment of cancer by nanotechnology.**

Because the nano-molecules of gold which stuck the surface of cancerous cell absorb the light of laser and convert it into heat which leads to burn and kill the infected cell.

16. **Reproduction is the way of living organisms to ensure the continuity of their species.**

Because by reproduction the living organism produces new individuals of the same kind.

17. **All types of asexual reproduction take place by only one individual.**

Because asexual reproduction includes mitosis division.

18. **Asexual reproduction needs neither special systems nor structures to occur.**

Because it takes place through mitotic division only through one individual.

19. **Asexual reproduction depends on the mitotic division.**

To obtain the produced individuals having a complete copy of genetic traits of the parent individual.

20. **The cells that are resulted by binary fission are identical and similar to the parental cell.**

Because they are resulted from the mitotic division.

21. **Binary fission is considered as mitotic division.**

Because two identical cells are produced, each one is identical to the original cell.

22. **The genetic material is doubled before the binary fission of the bacterial cell.**

To make each cell from the resulted two cells gets genetic material identical to the original cell.

23. **The parent cell which produces by binary fission disappears.**

Because it splits into identical cells.

24. **A colony may be formed through reproduction by budding.**

Due to the buds which remain connected to the parental cell, colony is formed.

25. **Starfish arms could be revived and give out a complete animal.**

Because this part contains a part of the central disc of the animal.

26. **Starfish reproduces asexually by regeneration.**

Because each lost arm can be regenerated and give out a complete animal if it contains a part of the central disc of the animal.

27. **The number of chromosomes in cells resulted by regeneration is (2N) as in the parental cell.**

Because regeneration is asexual reproduction that occurs by mitotic division.

28. **Vegetative reproduction is called by this name.**

Because it occurs without the need of seeds, but by the plants' vegetative organs.

29. **Asexual reproduction in plants does not need the presence of gametes.**

Because it is a vegetative reproduction occurs by the plants organs (leaves , roots and stems).

30. **There are no new races (new individual with other trait) of plants, when they reproduce by vegetative reproduction.**

Because vegetative reproduction depends on mitotic division, in which the produced cells contain a full copy of the genetic material of the parent cells.

31. • **Asexual reproduction produces offspring with genetic traits identical to those of their parents.**

   • **Asexual reproduction keeps the genetic structure of the living organism.**

Because it occurs through one parental individual and through a mitotic division as the new individual gets a genetic copy identical to the parent.

32. **Spore propagation is a type of asexual reproduction which is common in some fungi such as bread mould and mushroom.**

Because it occurs by only one parent through mitotic division, where the produced individuals have the same genetic traits.

33. **Sexual reproduction occurs in most higher living organisms of plants and animals.**

Because it depends on two main processes which are gametes formation and fertilization.

34. **Sexual reproduction depends on the meiosis division.**

Because by mitotic division, the gametes are formed which required to complete the sexual reproduction.

35. **The zygote has the same number of chromosomes of cells of parental organism.**

Because it is produced from combination of a male gamete (N) and a female gamete (N), each of them contains half number of chromosomes of the parental organism.

36. **Sexual reproduction is a source of the genetic variation between individuals.**

Because the phenomenon which occurs during the formation of gametes through the meiotic division which is called the crossing over phenomenon and also the offspring resulting from sexual reproduction combines the genetic traits from two sources.

37. **The number of chromosomes is constant in the same species which reproduce sexually.**

Due to meiosis division (which reduce the number of chromosomes) in gametes, then the combination of male gamete (N) and female gamete (N) to form a zygote which contains the whole number (diploid number) of chromosomes (2N).

4 What happens when ... ?

1. **The nucleus of the cell is removed.**

The cell division doesn't occur.

2. **The interphase before cell division does not occur.**

The genetic material will not be duplicated and each cell from resulting cells doesn't obtain a complete copy of genetic material.

3. **The centromere disappears from the animal cell.**

The spindle fibers are not formed therefore the cell division doesn't completed.

4. **Somatic cells divide mitotically in the human body.**

They will produce two cells contain the same number of chromosomes of the parent cell (2N).

5. **The number of chromosomes in the cells resulted from the mitotic division is different from the number of chromosomes in the parent cell.**

The resulted cells will have different properties from the parental cell which may cause damages to the organism.

6. **A liver gets injured or cutting a part of it.**
   The remaining cells undergo many mitotic divisions to compensate the missing part.

7. **Reproductive cells divide by meiosis division in the human body.**
   They will produce the gametes that contain the half number of chromosomes.

8. • **The parts of inner chromatids are exchanged in the first prophase.**
   • **Each two homologous chromosomes close to each other to form a tetrad.**
   Crossing over phenomenon occurs.

9. **Crossing over occurs at the end of prophase I in meiosis.**
   The genetic variation occurs among members of the same species.

10. **An amoeba cell divides three mitotic divisions.**
    The parental cell disappears and 8 identical cells are produced.

11. **Putting a yeast fungus in a warm sugary solution.**
    The yeast fungus reproduces asexually by budding forming a new fungus separated from the parent cell or it remains connected to the parent cell forming a colony.

12. **The bud in the yeast fungus is separated from the parental cell.**
    A new fungus is formed.

13. **Separating a starfish arm, while it contains a part of the central disc.**
    This part grows forming a new individual.

14. **Starfish losses one of its arms.**
    The starfish compensates its lost arm and the arm forms new individual if it contains a part of the central disc.

15. **Spores of bread mould fungus don't find a suitable environment.**
    They don't grow to give new organisms (fungi).

16. **Spores of bread mould fall on a wet piece of bread.**
    They grow forming new organisms (fungi).

17. **Rupturing of the sporangium of bread mould fungus.**
    A large number of spores are released.

18. **Cutting a part of a potato tuber and putting it in a suitable environment.**
    It grows forming a new plant.

19. **Fusion of sperm (male gamete) with an ovum (female gamete).**
    A zygote is produced which when it grows, it gives a new offspring with traits of its parents.

20. **No fusion occurs between male gamete and female gamete in the sexual reproduction.**
    The zygote will not be formed.
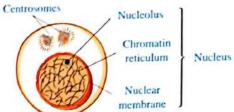
21. **Kind of living organism stops reproduction process.**
    This living organism will not produce new individuals of the same kind which causes the extinction of this living organism.

5 Important tables :

Before starting division, the cell passes through a phase called interphase in which :

- Some important biological processes occur to prepare the cell for division.
- The amount of DNA duplicates.

❶ Phases of mitosis :

The phase	The changes that occur in the phase	Figure
1. Prophase :	- Chromatin reticulum condenses, then appears in the form of chromosomes. - A network of spindle fibers is formed. - **At the end of this phase,** the nucleolus and nuclear membrane disappear.	Prophase
2. Metaphase:	Chromosomes which are connected with the spindle fibers are arranged along the cell equator.	Metaphase
3. Anaphase :	- The centromere of each chromosome splits lengthwise into two halves, so the chromatids separate from each other. - Spindle fibers begin shrink and two identical groups of chromosomes (each contains single chromatid) are formed.	Anaphase
4. Telophase :	- The spindle fibers disappear. - A nuclear membrane and a new nucleolus are formed at each pole of the cell. - The chromosomes convert into a chromatin reticulum again. - **At the end of this phase,** the cell divides into two new cells, the number of chromosomes in each of them is equal to the number of chromosomes of the parent cell (2N).	

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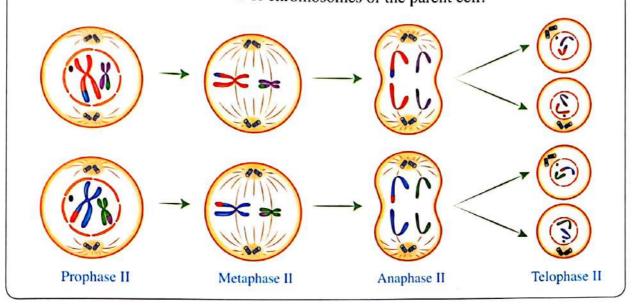
② Phases of meiotic division :

A) Phases of first meiotic division :

The phase	The changes that occur in the phase	Figure
1. Prophase I :	- Chromatin reticulum intensifies and appears in a form of distinct chromosomes. - Chromosomes are arranged in homologous pairs, each pair consists of 4 chromatids which are called a tetrad. **At the end of this phase :** - Crossing over phenomenon occurs. - Nuclear membrane and nucleolus disappear. - Each two homologous chromosomes (in the tetrad) move away from each other. - The spindle fibers appear and connect to the chromosomes at centromere.	 Prophase I
2. Metaphase I :	Chromosomes pairs arrange at the cell equator.	 Metaphase I
3. Anaphase I :	The spindle fibers shrink, so every two homologous chromosomes move away from each other.	 Anaphase I
4. Telophase I :	- The spindle fibers disappear. - A nuclear membrane and a new nucleolus are formed at each pole of the cell. - **At the end of this phase,** each cell divides into two cells, the nucleus of each of them contains half the original number of chromosomes of the parent cell chromosomes (i.e. each cell contains (N) chromosomes).	 Telophase I

B) Phases of second meiotic division :

- Each cell of the two cells resulted from the first meiotic cell division is divided in a way similar to the mitotic cell division.
- In the final phase (telophase II) of this division, four cells are produced and each of them contains half the number of chromosomes of the parent cell.

| Prophase II | Metaphase II | Anaphase II | Telophase II |

6 Comparisons :

❶ Somatic cell and reproductive cell :

Points of comparison	Somatic cell	Reproductive cell
No. of chromosomes :	Diploid number (2N)	Diploid number (2N)
Kind of division :	Mitotic cell division (Mitosis) [Neural cells and red blood cells are not divided]	Meiotic cell division (Meiosis)
No. of resulting cells :	- Two cells are resulted from the division of the somatic cell. - Each cell contains the same number of chromosomes of the parent cell.	- Four cells are resulted from the division of the reproducive cell. - Each cell contains half the number of chromosomes of the parent cell.
Examples or the location of the cell :	All body cells except the reproducive cells like : - (Liver, skin, kidney, ...) in humans and animals. - (Roots, stem, leares, ...) in plants.	- Testis and ovary in humans and animals. - Anther and ovary cells in plants.

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2 Reproductive cell and gamete :

Points of comparison	Reproductive cell	Gamete
No. of chromosomes :	Diploid number (2N)	Haploid number (N)
Kind of division :	Meiotic cell division (Meiosis)	Gamete doesn't divide.
Importance :	The production of gametes.	The occurrence of the sexual reproduction process.
Examples or the location:	- Testis and ovary in humans and animals. - Anther and ovary cells in plants.	- Sperm and ovum in humans and animals. - Pollen grain and ovum in plants.

3 Mitosis (mitotic cell division) and meiosis (meiotic cell division) :

Points of comparison	Mitosis	Meiosis
Site of occurrence :	It occurs in the somatic cells.	It occurs in the reproductive cells
Importance :	- Growth of living organisms. - Compensation of damaged cells. - Completing the asexual reproduction process.	Formation of gametes : In males ⟶ sperms or pollen grains. In females ⟶ ova or ovules.
Resulting cells :	Two cells, each cell contains the same number of chromosomes of the parent cell (2N).	Four cells, each cell contains half number of chromosomes of the parent cell (N).
Stages of division :	One stage includes four phases which are : [Prophase - Metaphase - Anaphase - Telophase].	Two stages : - First meiotic division. - Second meiotic division. [Each of them includes four phases].
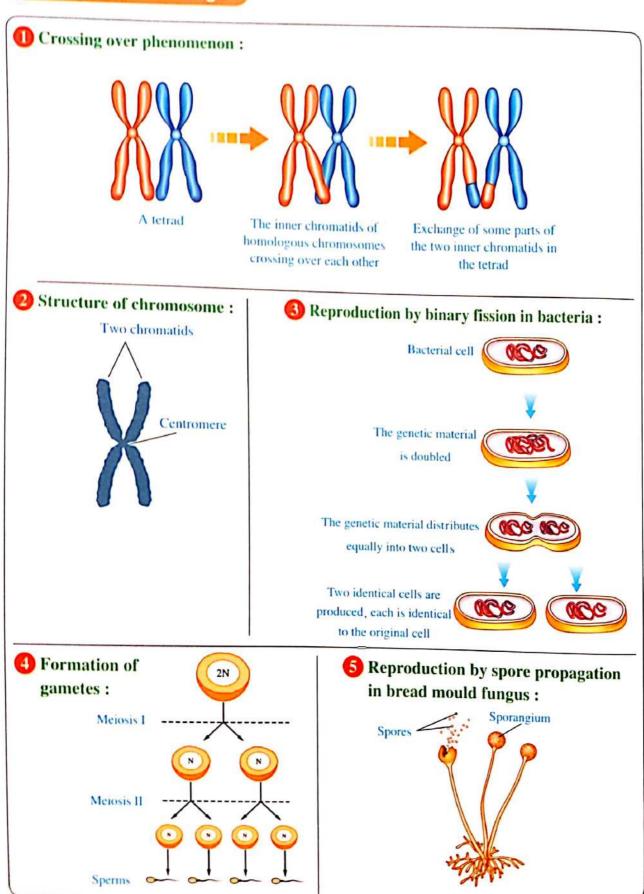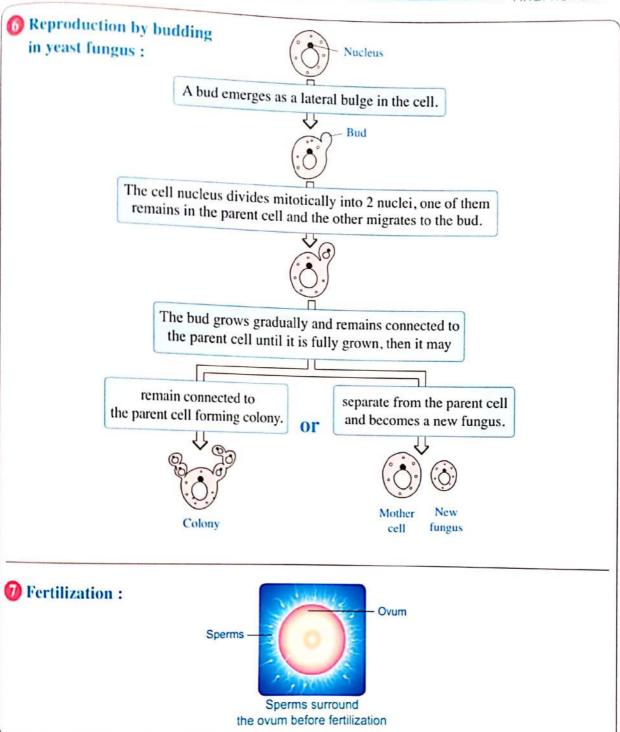
4 **Reproduction by budding and reproduction by regeneration :**

Points of comparison	Reproduction by budding	Reproduction by regeneration
Definition :	It is a type of asexual reproduction produces new individuals by formation of buds in the parent cell.	It is the ability of the missing part from some living organisms to grow forming a complete organism.
Examples :	- Unicellolar organisms like : Yeast fungus. - Multicellular organisms like : Hydra and Sponges.	Starfish.

5 **Sexual reproduction and asexual reproduction :**

Points of comparison	Sexual reproduction	Asexual reproduction
Number of parents :	By two living organisms (individuals) a male and a female.	By one living organism (a single parent).
Kind of cell division :	It depends on meiotic cell division gametes formation.	It depends on mitotic cell division only.
Genetic traits of the new individuals :	The new individual carries combined traits (characteristics) of both parents.	The new individual exactly looks like its parent.
The occurrence :	- It occurs in : Higher (multicellular) living organisms : Human - Plants - Animals.	- It occurs in : Single-celled (unicellular) living organisms : Amoeba - Yeast fungus - Bread mould fungus.
Conditions :	It requires special reproductive organs and systems to occur.	It doesn't require special systems or structures in the living organism to occur.

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7 Important drawings :

1 Crossing over phenomenon :

A tetrad

The inner chromatids of homologous chromosomes crossing over each other

Exchange of some parts of the two inner chromatids in the tetrad

2 Structure of chromosome :

Two chromatids

Centromere

3 Reproduction by binary fission in bacteria :

Bacterial cell

The genetic material is doubled

The genetic material distributes equally into two cells

Two identical cells are produced, each is identical to the original cell

4 Formation of gametes :

2N

Meiosis I

N   N

Meiosis II

N   N   N   N

Sperms

5 Reproduction by spore propagation in bread mould fungus :

Sporangium

Spores

6 Reproduction by budding in yeast fungus :

Nucleus

A bud emerges as a lateral bulge in the cell.

Bud

The cell nucleus divides mitotically into 2 nuclei, one of them remains in the parent cell and the other migrates to the bud.

The bud grows gradually and remains connected to the parent cell until it is fully grown, then it may

remain connected to the parent cell forming colony. **or** separate from the parent cell and becomes a new fungus.

Colony

Mother cell   New fungus

7 Fertilization :

Ovum

Sperms

Sperms surround the ovum before fertilization

Scanned with CamScanner

Final Examinations 2020 ❓

1 Cairo Governorate

Answer the following questions :

Question 1

Ⓐ Complete the following sentences :

1. The image can be received on a screen is called .... image.
2. At the end of ...., the nucleolus and the nuclear membrane disappear at the mitotic division.
3. The sun takes about 220 million years to complete one cycle around the center of ....
4. The chromosome consists of two connected threads at the .... , each is called ....

Ⓑ What is meant by ... ?

1. The light reflection phenomenon.
2. Average speed.
3. Reproduction.

Ⓒ A train starts to move from rest in straight line, its speed reaches 36 m/sec. after 9 second. **Calculate** the acceleration of the train, and **find its type**.

Question 2

Ⓐ Choose the correct answer :

1. Bread mold fungus reproduces asexually by ....
   a. regeneration   b. binary fission   c. budding   d. sporogony

2. The two gases that have produced galaxies, stars and the universe over millions of years are ....
   a. Helium and Oxygen   b. Helium and Nitrogen
   c. Helium and Hydrogen   d. Oxygen and Hydrogen

3. The virtual-upright magnified image formed in case of ....
   a. concave lens   b. convex mirror
   c. plane mirror   d. concave mirror and convex lens.

4. The distance moved through a unit time is ....
   a. acceleration   b. displacement   c. length   d. speed

5. The crossing over phenomenon occurs at the end of ....
   a. prophase I   b. metaphase I   c. anaphase I   d. telophase I

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B Mention the type of physical quantity of each :

1. Mass. 2. Force.

C Illustrate with drawing the image formed by concave mirror when the object is at the center of curvature of the mirror, then mention the properties of this image ?

Question 3

A Re-write the following statements after correcting the underlined word :

1. When an object move by **relative speed** it cover equal distances in equal periods of time.
2. The solar system consists of the sun and **seven** planets that rotate around it.
3. The number of chromosomes in the human somatic cell is about **a quarter** of those in gametes.
4. The scientist **Fred Hoyle** established the theory of nebula to explain the origin of solar system.
5. The short-sightedness is treated by using a **convex lens**.
6. **Regular speed** is the value of displacement in one second.

B What would happen in the following cases :

1. Combination of the male gamete and female gamete.
2. The incident light ray falls passing the focus of the convex lens.

C Give reasons for :

1. The long-sightedness person can't see the near objects clearly.
2. The focal length of concave mirror can be determined by knowing its radius of curvature.

Question 4

A Write the scientific term for the following statements :

1. The covered distance at certain direction.
2. The value of change of an object's speed in one second.
3. The angle between the reflected light ray and the perpendicular line on the reflecting surface from the point of incidence.
4. The ability of some animals to compensate their missing parts.
5. Physical quantity which has magnitude only and has no direction.
6. Change of an objects position as time passes according to the position of another object.

B Compare between each of the following :

1. Acceleration and deceleration.
2. Somatic cells and reproductive cells (in terms of its types of the cell division).

2 Giza Governorate

Answer the following questions :

Question 1

A Choose the correct answer :
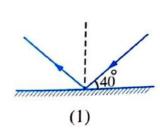
1. Which of the following are consider from vector physical quantities ? ....
   - a. mass and force
   - b. displacement an acceleration
   - c. radius and distance
   - d. force and time
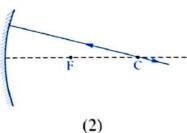
2. The object's image that formed behind plane mirror always is ....
   - a. virtual, magnified and erect
   - b. real, diminished and inverted
   - c. real, equal to the body and reversed
   - d. virtual, equal to the body and erect

3. The scientist who established the modern theory of origin the solar system is ....
   - a. Fred Hoyle
   - b. Laplace
   - c. Moulten
   - d. Newton

4. Chromosome is chemically consists of nucleic acid .... and protein.
   - a. HNO_3
   - b. H_2SO_4
   - c. DNA
   - d. HCI

B A racer cover a distance (50 meter) by running within a time (5 second), then return to the start point walking within (20 second). Calculate average speed of the racer :

1. While running
2. While returning back.

C Calculate the value of reflecting angle in both the two figures :

(1)

(2)

Question 2

A Complete the following statement :

1. When object speed decreases by passing time, then it moves at .... acceleration.
2. If the focal length of a convex mirror is (10 cm), then its radius of curvature of its reflecting surface equal ....
3. Distance in space is measured by .... unit.
4. The .... division occurs in liver cells.

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B An object is placed at (3 cm) from the optical centre of a lens, then a magnified virtual image for the object is formed :

1. Mention the type of lens.

2. Explain by drawing the path of the rays that form the object's image.

C What happen :

1. When combination of male gamete with female gamete to form zygote.

2. To the acceleration of an object moves at uniform speed.

Question 3

A Write scientific term for the following statements :

1. The distance covered at a certain direction from the primary position of movement towards its final position.

2. The distance between principle focus and optical centre of the lens.

3. The process of exchanging the two inner parts of chromatids of each tetrad.

4. It is the wide and extended space that contains galaxies.

B Compare between each of the following :

1. Speed – velocity   (according definition).

2. Amoeba and yeast fungus   (according to the type of asexual reproduction).

C What is the name of the phase where the following changes occurs during cell division :

1. Chromosomes are arranged along the equator of the cell.

2. Doubling the genetic material.

Question 4

A Correct the underline words :

1. For identifying force it is necessary to know its **magnitude only**.

2. Lens is transparent medium that **reflect** light and it is limited with two spherical surface.

3. The **Big Bang** theory depends on the presence of something that looks like cloud or nebula in space.

4. Gamete contain **diploid** number of chromosomes.

B Give reasons for :

1. The train moves with an irregular speed.

2. Sexual reproduction is a source of the variation between individual.

C What is meant by ... ?

1. The relative speed of car relative to a moving observer equals zero.

2. Meiosis division is a reduction division.

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3 Alexandria Governorate

Answer the following questions :

Question 1

A **Complete the following sentences :**

1. The actual length of the path that a moving object takes from the starting point of movement to the end point is known as .... and it is considered as .... physical quantity.

2. The image always equals the object and can't be formed on a screen in the .... mirror.

3. In case of the .... division of the cells no changing in the genetic traits.

B **A runner covered a distance of 240 meters in 16 seconds, then he returned back walking to the start point in 2 minutes. Calculate the average speed of his complete trip.**

C **Define the following :**

1. The universe.   2. Reproducing by regeneration.

Question 2

A **Choose the correct answer :**

1. The graphic relationship between distance and time which is represented by a straight line pass by the origin point is ....

   a. irregular speed   b. uniform speed

   c. irregular acceleration   d. uniform acceleration

2. From physical quantities that is enough to be identified knowing its magnitude only is ....

   a. the force   b. the displacement   c. the acceleration   d. the mass

3. The formed image of an object in the concave lens at any distance is ....

   a. virtual diminished   b. virtual enlarged

   c. real diminished   d. real enlarged

4. According to Laplace theory in 1796, the solar system was a glowing gaseous sphere known as ....

   a. the sun   b. the planets   c. the stars   d. the nebula

5. It is possible to produce new plants identical to the mother plant by ....

   a. forming gametes b. fertilization   c. budding   d. tissue culture

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B Give reasons for the following :

1. The word Ambulance is written laterally inverted on Ambulance car.

2. Binary fission is considered as a mitotic division.

C What is the measuring unit of the displacement ?

Question 3

A Write scientific term for the following statements :

1. The speed of a moving object relative to a standing or a moving observer.

2. A spherical mirror its shining surface is a part of the outer surface of the sphere.

3. Millions of the stars which arranged in a distinctive shape.

4. Special organs for reproduction in algae and fungi.

B When do the following happen :
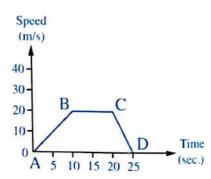
1. Passing of a light ray through a lens without refraction.

2. Moving of an object with a negative uniform acceleration.

C 1. Illustrate how the real equal image of an object is formed in the mirrors.

2. The opposite figure shows a phenomenon happens in the living organisms, **mention** :

a. The name of the phenomenon.

b. The name of the phase in which the phenomenon occurs.

Question 4

A The opposite graph represents the movement of a car from rest point, study the graph and answer :

1. Moving with uniform acceleration is represented by the straight line ....

2. Calculate the acceleration of the car during its movement from the point (B) to (C).

B Compare between short-sightedness and long-sightedness concerning :

1. The radius of the eyeball.

2. The type of lens that is used in treatment.

C What is the importance of the following :

1. The attraction force of the Sun.

2. The nucleic acid in the chromosome structure.

3. The anther in the flowering plants.

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4 Kalyoubia Governorate

Answer the following questions :

Question 1

A Choose the correct answer :

1. The convex lens which has great thickness from the following, its focal length is ....
   a. 4 cm
   b. 6 cm
   c. 8 cm
   d. 10 cm

2. The binary fission reproduction takes place in ....
   a. Amoeba and Hydra
   b. yeast and bacteria
   c. Amoeba and sponge
   d. Bacteria and Euglena

3. The two gases which present within minutes of Big Bang are ....
   a. Hydrogen and helium
   b. Hydrogen and oxygen
   c. oxygen and Helium
   d. Hydrogen and nitrogen

4. From the scalar physical quantities ....
   a. radius and area
   b. time and force
   c. acceleration and speed
   d. mass and displacement

5. Which of the following organs show the right number of chromosomes ?

The choice	a.	b.	c.	d.
The organ	liver	testes	uterus	ovaries
Its cells has (2n)	✓	✗	✗	✓
Produce cells has (n)	✓	✓	✗	✓

B What are the results which happens due to the following .... ?

1. A nuclear explosion for a star near the sun (according to Fred Hoyle theory)

2. A starfish loses one of its arms which has a part of the central disc.

3. Putting an object in front of convex lens at its focus.

C Study the following figure which explains the steps of one of the biological phenomenon, then answer the following questions :
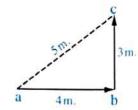
1. What's the name of this phenomenon ?

2. Mention the phase in which that phenomenon occurs.

3. What is the type of its division ?

4. What are the results which are produced if that phenomenon did not happen ?

Question **2**

Ⓐ Write the scientific term of each statement from the following :

1. Asexual reproduction occurs by different parts of the plant without needing seeds.
2. The actual length of the path that a moving object covers from the starting point to the ending point.
3. Arrangement, harmony and distinctive shapes of the groups of stars in the universe.
4. Thread like bodies present in the cell's nuclei and they represent the genetic material of the living organism.
5. An optical piece that is used to treat a vision defect which causes the formation of image in front of the retina.

Ⓑ Two cars start their movement on an inclined road at the same moment, the first car rises up the inclined road with regular speed equal 30 m/sec. and the second car moves down the inclined road with initial speed equal 10 m/sec, and uniform acceleration of 5 m/sec². If the two cars meet each other after 5 seconds passes from that moment find the relative speed of the first car that is observed by the driver of the second car when meeting of the two cars.

Ⓒ When will the following things happen ... ?

1. The distance covered by a body equals the amount of its displacement.
2. Reflection of light ray falls on spherical mirror on itself.

Question **3**

Ⓐ Rewrite the following statements after correcting the underline word :

1. If the angle between the incident light ray and the reflecting surface equal 30°, so the angle of reflection equal **30°**.

2. In the opposite figure an object moves Eastward from point (a) to point (b) during two seconds, then to point (c) Northward in 3 seconds, so its velocity through that period is **1.4 m/sec**.
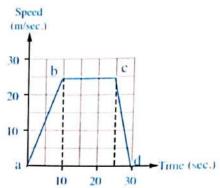
3. Yeast fungus reproduces asexually by **regeneration**.

4. An object moves in a circular path its radius (r) to cover a distance equal (πr), so its displacement equal **2 πr**.

5. When the object covers the double of distance at the same time, so its speed **decreases to quarter**.

B A car moves in straight line, and its speed recorded within 30 seconds, then it was represented graphically as shown in the opposite figure :

From the graph extracts the needed information to complete the following table :

Speed (m/sec.)

Phases of the car movement	phase a b	phase b c	phase c d
The initial speed (V_1)	.... (1)	25 m/sec	.... (2) ....
The value of acceleration	2.5 m/sec^2	.... (3)	.... (4) ....
The description of movement	.... (5)	.... (6)	The car moves with negative acceleration

C Mention one difference between each of the following :

1. Regular speed and irregular speed.

2. The virtual image of an object which is formed by each of concave lens, and convex lens.

Question 4
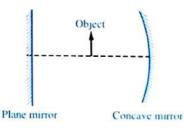
A Give reasons for each of the following :

1. Pilots take in consideration the velocity of the wind during flying.

2. The mitotic division is very important for the child's body and not the meiotic division.

3. The universe is in a continuous expansion.

4. Most of people can't write in a correct way, while they are seeing the paper through a plane mirror.

5. The reproduction by spores is one of the forms of asexual reproduction.

B In the opposite figure :

An object was put in the mid distance between a concave mirror (its focal length is 10 cm) and a plane mirror, so the image was formed by the plane mirror at a distance 30 cm from the plane mirror.

1. Draw the path of light rays for the formed image by the concave mirror.

2. Mention the properties of the formed image by using the concave mirror.

C Mention the name of the phase in which the following changes occur during the cell division :

1. At its end the nucleolus and nuclear membrane disappear.

2. Two identical and separated groups of chromatids are formed.

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5   Menofia Governorate

Answer the following questions :

Question 1

A Write the scientific term for each :

1. The upright image that cannot be received on a screen .
2. A straight line that passes through the center of curvature of a mirror and its pole.
3. A phase of division during which the cell prepare itself by duplicating its genetic matter.
4. An optical piece thick at its middle and thin at the terminals.
5. A type of reproduction depends on one parent without production of gametes.

B Give reasons for :

1. The body that moves by uniform velocity has acceleration equal zero.
2. Sexual reproduction produces individuals different of their parents.
3. The gamete contains half number of chromosomes existed in the somatic cell.

C A body moves with constant velocity covering 300 meters in 10 seconds then it returns back to the start point during 50 seconds, **calculate** :

1. The average speed of the body during return back only.
2. The average speed of the body during going and returning together.

Question 2

A What is meant by each :-

1. The distance between pole of a spherical mirror and its primary focus is 10 cm.
2. The distance covered in fixed direction equal 100 m.

B What happened when a starfish loses an arm with a part of central disc.

C Compare between each :-
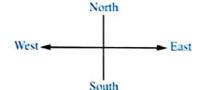
1. The acceleration and the mass (in term of type of physical quantity).
2. Bread mold fungus and Sponge (in term of the way of reproduction)
3. Big Bang theory and nebular theory (in term of their importance).
4. A train covers 72 kilometers in an hour and a car covers 30 meters in one second (in term of the magnitude of the speed)
5. Mitotic division and meiotic division (in term of the cells in which they occur).

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D An object placed at a distance of 15 Cm of the optical center of a symmetric convex lens, a real minimized image is formed for the object. then when the object is moved 5 Cm towards the lens, a real image equal to the object is formed, determine :

1. The focal length of the lens.

2. Draw only the path of rays that explain the object and its image when it placed at a distance 15 cm of the lens optical center ?

Question 3

A What is the role of the following :

1. The spindle fiber during cell division.   2. The chromosome

B Determine the type of the optical piece (lens or mirror) then mention its type (concave – convex – Plane) when it is able to :

1. Form a virtual upright minimized image in the same side of the object, whatever its distance of it.

2. Form a virtual upright enlarged image on the other side of the object, only if the object placed at a distance less than its focal length.

C Complete the following by suitable words :

1. The scientist who establish the crossing star theory that explains the origin of the solar system is ....

2. The ability of the liver to regenerate under certain conditions if injured represents the scientific base for .... surgery.

3. .... phenomenon is occurred between the inner chromatids of the tetrad.

4. The device that is used by the astronomers to identify the different wave lengths emitted by the Sun is ....

D A person moved from start point (12) meters to the west then he returned in the same path 8 meters to the east calculate :
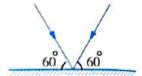
1. The distance covered by the object from the start point.

2. The displacement (magnitude and direction).

North
West ← | → East
South

Question 4

A Choose the correct answer :

1. When a car moves by positive uniform acceleration of (6 m/sec^2) this means ....

a. The car speed increases by the rate of (6 m/sec) every second.

b. The car speed decreases by the rate of (6 m/sec) every second.

c. The car covers 6 meters each second.

d. The car acceleration increases by the rate of (6 m/sec^2) every second.

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2. When incident light ray falls on a surface of a plane mirror then reflected as in the figure the reflecting angle equals ....

a. 60°   b. 90°

c. 120°   d. 30

3. If each muscle cell in a male rabbit contains 22 pairs of chromosomes, therefore number of chromosomes in a cell of testis wall equal .... chromosomes.
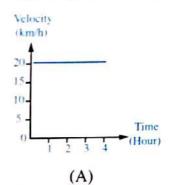
a. 44   b. 11   c. 22   d. 88
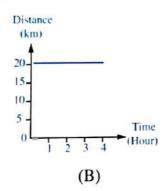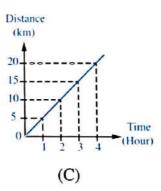
4. The image of near objects is formed behind the retina when these objects are placed in front of the eye of long-sightedness person because ....

a. The more convexity of the eye lens surfaces.

b. The decrease in the eye diameter.

c. The decrease in the focal length of the eye lens.

d. The increase in the eye diameter.

5. According to the nebular theory for the scientist Laplace, the nebula losses its heat gradually with the time which causes ....

a. Decrease in the speed of rotation and increase in the volume.

b. The nebula takes spherical shape with increase its speed.

c. The nebula takes spherical shape only.

d. Decrease in the volume and increase in the rotation speed.

B Three cars (A, B, C) their motion are represented by the following graphs. Study the graphs then answer :

(A)   (B)   (C)

First :

1. The speed of car (A) equals (   ) km/h.

2. The speed of car (B) equals (   ) km/h.

3. The speed of car (C) equals (   ) km/h.

Second :

The relative speed of car (A) to an observer in car (C) when :

1. Both cars (A and C) move in the same direction equals (   ) km/h.

2. Both cars (A and C) move in opposite direction equals (   ) km/h.

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6 Dakahlia Governorate

Answer the following questions :

Question 1

A Complete the following statements :

1. As the distance between the planet and the sun increases, the sun's gravitational force .... and its motion around the Sun becomes ....

2. The convex mirror is a part of a sphere, its .... surface is the reflecting surface and in the concave mirror .... surface is the reflecting surface.

3. In the animal cell, the spindle fibers are formed by .... , while in plant cell the spindle fibers are formed from .... at the cell poles.

4. .... reproduction in plant's happens by plant's organs without the need of ....

B 1. Show by drawing the relation (distance – time) graph for an object moves at a uniform speed and then it stops.

2. Sexual reproduction depends on two main processes, what are they ?

C A person can be seen near objects clearly but far objects seem distorted :

1. What is the name of this vision defect and what are its reasons.

2. How can you correct this defect, and give reason for your answer ?

D From the opposite figure calculate :

1. Total distance.

2. Displacement

3. Velocity after the first five seconds.

Displacement (m) vs Time (sec.) graph

Question 2

A Correct the underline words :

1. Ahmed takes 10 minutes to transfer from his home to work moving at an average speed of 3 m/s, the distance between home and work **equal 3** km.

2. **The modern theory of the world** explains the origin of the universe.

3. The properties of the formed images by the convex lens depend on **the length** object from the lens.

4. The incident light ray passes through the center of curvature of a concave mirror, it reflects **parallel to its principle axis**.

5. **The focus** is the point lies in the middle of the reflecting surface of the mirror.

6. The relative speed of a moving car relative to constant observer **is less than** its real speed.

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B An object was placed at a distance 20 cm from optical center of a lens then a real, diminished image is formed and when the object moves 8 cm toward the lens then a real, equal image to the object is formed :

1. What is the type of the lens and describe it ?
2. Calculate the focal lens of this lens.

C 1. **Mention** the general structure of the chromosome, show your answer with drawing and label it.

2. **What is meant by :**

   1. Crossing over phenomenon.   2. Contact lens.

D What is the name of each living organism and mention the type of asexual reproduction in each :

1.   2.

Question 3

A Write the scientific term of each of the following :

1. The rate of change of the distance.
2. Groups of stars that rotate together in space by the effect of gravity.
3. The image that cannot be received on a screen.
4. An apparatus is used to see the tiny bodies that cannot be seen by the naked eye.

B Give reasons for :

1. Asexual reproduction keeps genetic structure of the living organism.
2. Concave mirror is used to generate high heat energy.
3. Real image cannot be formed by using a concave lens.
4. The object speed increases by decreasing the time taken to cover a certain distance.

C Compare between each of the following :

Somatic cell and reproductive cell (according to) :

a. Type of division.
b. Number of the produced cell from division of one cell from each one.

D Show with drawing formation enlarged – erect image by using spherical mirror.

Question 4

A Choose the correct answer :

1. .... is a scalar physical quantity.
   a. time of tripe
   b. the force
   c. the pressure
   d. displacement of object

2. Number of chromosomes in sperm is .... number of chromosomes in an ovum.
   a. double
   b. half
   c. equal
   d. quarter

3. The nucleolus and nuclear membrane disappear in ....
   a. metaphase
   b. telophase
   c. prophase
   d. interphase.

4. If you put an object in front of a plane mirror, the ratio between the length of the image and the length of the object is ....
   a. more than one
   b. not equal one
   c. less than one
   d. equal to one

B A car moves by regular speed equals 90 km/h on free road of Banha, then the driver used the brakes the car stops after 10 seconds, calculate the acceleration and what is its type ?

C What is the importance each of the following :

1. Interphase in cell division.
2. Convex mirror in your car.

D Show with drawing, and explain what happen in the following phases :

1. Anaphase
2. Anaphase I

7 Sharkia Governorate

Answer the following questions :

Question 1

A Write the scientific term of each of the following :

1. The value of change in the object speed in one second.
2. A mirror, always forms small image for the object.
3. It contains the Sun and the solar system.
4. The point of connection of two chromatids of the chromosome together.
5. Asexual reproduction occurs by different parts of the plant without seeds.

B Mention the properties of the formed image in each of the following cases :

1. An object is put in front of a convex lens at a distance less than its focal length.
2. An object is put at the focus of a convex lens.

ⓒ **From the opposite figure :**
1. Write the name of this phase ?
2. When does this phase happen ?
3. Why does the cell passes through this phase ?

Question 2

Ⓐ **Complete the following statements :**
1. Acceleration is considered one of .... physical quantities, while time is considered one of .... physical quantities.
2. .... and .... are used during wars to follow battle.
3. Long–sightedness caused as a result of .... of the radius of the ball thus the retina is .... to the eye lens.
4. The Big Bang theory explain the origin of .... , while the Nebular theory explain the origin of ....
5. Somatic cells are divided by .... , while reproductive cells are divided by ....

Ⓑ **A moving car by a uniform speed covers 80 meters in 4 seconds, then the driver press the brakes, so it stopped after 4 seconds :**
Find : The magnitude of the acceleration :
1. Within 1st 80 meters.
2. After pressing the brakes.

ⓒ **Mention the name of the phase that indicates the following changes during the cell division :**
1. Spindle fibers begin to shrink, so two identical groups of chromatids are formed.
2. At the end of this phase, the nucleoeus and nuclear membrane disappear.
3. It occurs when a complete set of chromosomes that have the same number of the mother cells chromosomes, is formed.

Question 3
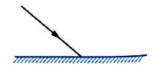
Ⓐ **Choose the correct answer :**
1. A student took 10 minute to move from his home to his school moving at average speed 2 m/s, which of the following equals the distance between his home and school ....
   a. 48 m   b. 84 m   c. 1.2 Km   d. 3.6 Km

2. **In the opposite figure :**
   If the angle between the incident ray and the surface of the plane equals 130°, Then the angle of reflection equals to ....
   a. 40°   b. 50°   c. 90°   d. 130°

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3. The solar system consists of the Sun and .... plants revolve around it.

a. 7   b. 8   c. 9   d. 10

4. The ratio between the number of chromosomes present in the gametes produced by meiotic cell division to the number of chromosomes present in somatic cell is ....

a. quarter   b. double   c. third   d. half

5. The parental individual disappears when the reproduction occurs in the ....

a. bacteria   b. yeast   c. bread mould fangus   d. mushroom

B The displacement is a vector quantity, which identified by knowing both magnitude and direction. What is meant by :

1. Amount of displacement.   2. Direction of displacement.

C Two cars move in the same direction if the speed of the first car is 30 km/h and the second car is 50 km/h.

Calculate the relative speed of the second car relative to an observer :

1. Standing on the ground.   2. Sitting in the first car.

3. What are you conclude from the resultants ?

Question 4

A Give reasons for :

1. The motion of a train can be considered from examples of motion in one direction.

2. The human being noticed that when he looked at the still water surface, he could see as image of his face in the water.

3. You could see the person who fixes the watches use a magnifier.

4. The constancy of the planets in their orbits around the Sun.

5. The mitosis division is very important for the children.

B Explain how to determine the focal length of a concave mirror (explaining your answer by drawing).

C A body moves in a straight line, and the distances covered in different times is recorded in the opposite table :

The Distance (m)	10	20	30	40	50
The time (s)	5	10	15	20	25

1. Draw the relation between (distance – time) graphically that is obtained from the values shown in the table.

2. Calculate the speed of moving a body.

8 Gharbia Governorate

Answer the following questions :

Question 1

Ⓐ Complete the following statements :

1. The distance that a moving object covers within a unit time is known as ....
2. The founder of the modern theory is the scientist ....
3. Mitosis occurs in the .... cells of living organisms.
4. Mass is considered from .... physical quantity.
5. The .... image can be received on a screen.

Ⓑ What is meant by each of the following ... ?

1. The tetrad.
2. The distance between the principal focus of a spherical mirror and its pole = 20 cm.
3. The value of the length of the shortest straight line between two positions = 5 m.

Ⓒ A train moves at a speed 40 m/sec. and when the brakes is used it moves with a decelerating 2 m/sec². **Calculate** the time taken to stop the train.

Question 2

Ⓐ Choose the correct answer :

1. When an object moves with acceleration equals zero, this means that ....
   a. The object speed is variable.   b. the object speed is uniform.
   c. the object speed is increasing.   d. the object speed is decreasing.

2. The crossing over phenomenon takes place at the end of ....
   a. prophase I   b. metaphase I.   c. anaphase I.   d. telophase I.

3. If the speed of a car is 72 km/hour, this means that its speed equals .... m/sec.
   a. 16.   b. 18.   c. 20.   d. 40

4. The scientists believe that the universe emerged from a massive explosion of gaseous ball and it is in ....
   a. continuous contraction.   b. contraction then expansion.
   c. expansion then contraction.   d. continuous expansion.

5. A body of length 4 cm is placed at a distance of 8 cm from a convex mirror, so the length of the formed image becomes ....
   a. 16 cm   b. 8 cm   c. 4 cm   d. less than 4 cm

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B What happens in the following cases :

1. Putting a yeast fungus in a warm sugary solution.
2. A light ray is incident passing through the center of curvature of a concave mirror.
3. Focusing laser on the gold Nano-molecules in the cells infected by cancer.

C Mention the importance of each of the following :

1. The centrosome in the animal cell.
2. A convex mirror is put at the left side of the driver of the car.

Question 3

A Correct the underline words :
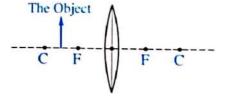
1. A moeba reproduces by **budding**.
2. The speed of car can be identified directly by the **compass**.
3. Contact lenses can stick to **eye iris** and can be removed easily.
4. Sudden violent **chemical** reactions occur with in the star which led to its explosion.
5. **Acceleration** is the actual length of the path that a moving object takes from the starting point of movement to the end point.

B Give reasons for :

1. Occurrence of interphase before starting the mitosis division.
2. Pilots take in consideration the velocity of the wind.
3. The moving car with a certain speed seems to be at rest to the moving observer with the same speed and the same direction.

C Copy the opposite diagram in your answer paper then :

1. Draw the direction of the rays which form the image of the body.
2. Mention the properties of the formed image.

The Object
C   F   F   C

Question 4

A Write the scientific term for each of the following :

1. The point of connection of the two chromatids of the chromosome during the cell division.
2. The change of an object's position as time passes according to the position of another object.
3. The space which contains all the galaxies, stars, planets, moons, living organisms and everything.
4. A point inside the lens that lies on the principal axis in the mid distance between its faces.
5. The value of change of an object's speed in one second.

B Compare between each of the following :

1. Pollen grains and sperms.   (according to : site of formation)

2. Average speed and irregular speed.   (according to : the definition)

3. Short-sightedness and long-sightedness.

(according to : the type of lens which is used to treat each one)

C If the number of chromosomes in a starfish mother cell is (2N), how many chromosomes are there in the cells resulted by regeneration ? Why ?

9 Damietta Governorate

Answer the following questions :

Question 1

A Complete the following statements :

1. Displacement is considered .... physical quantity, while the mass is considered .... physical quantity.

2. If the fertilized ovum contains 8 pairs of chromosomes this means that the unfertilized ovum contains .... chromosomes.

3. Chemically, the chromosome consists of .... and ....

4. If the speed of a car is 72 Km/hour this means that its speed equal .... m/s.

5. The solar system is located in one of the .... arms of the .... galaxy.

6. Bread mould fungus reproduces asexually by .... , while hydra organism reproduces asexually by ....

B Two cells are divided, one in a female liver and another in her ovary :

Mention : 1. The kind of cell division in each cell.

2. The number of cells produced from each division.

3. The number of chromosomes in each resultant cell.

C Show by labeled drawing only :

1. Formation of the image of a body which is placed between the center of curvature of a concave mirror and its focus.

2. Formation of the image of a body which is placed between the optical center of a convex lens and its focus.

Question 2

A Write the scientific term for each of the following :

1. The value of speed of a moving object relative to constant or moving observer.

2. The continuous separation between galaxies in the universe due to their regular motion.

3. The process of genes exchanging between the two inner chromatids of the tetrad.

4. The image cannot be received on a screen.

5. The part which is responsible for pulling the chromosomes towards the two poles of the cell during anaphase of cell division.

B Give reasons for :

1. Mitotic division is important for children.

2. The object that is placed at the focus of a convex lens has no image.

3. The body which moves at a acceleration can't move at a regular speed.

C From the following figures answer the questions :

Figure (1)	Figure (2)
Distance (m) graph with points B, C, A and Time (sec.) axis 1. Determine the intervals during which the body moves at uniform speed. 2. The time intervals during which the body at rest.	- **The opposite figure :** Represents a phase of division of a reproductive cell. 1. Mention the name of this phase. 2. What is the type of cellular division it belongs to ? 3. Mention the importance of this type of division.

Question 3

A Choose the correct answer :

1. A short sighted person sees the far objects distorted as their image formed ....
   a. on the retina   b. behind the retina   c. in front of the retina   d. in front of the lens

2. Meiotic division in flowering plants occur in the anther to produce ....
   a. Pollen grains   b. ova   c. sperms   d. chromosomes

3. The two factors which can be used to describe the motion of a body are the ....
   a. speed and time   b. distance and time
   c. area and time   d. displacement and speed

4. The source of stars energy (such as the Sun) is ....
   a. Chemical reactions   b. nuclear reactions
   c. burning gases   d. inflammable gases
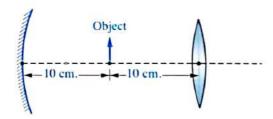
5. Reproduction in yeast and starfish depends on ....
   a. fertilization   b. regeneration   c. meiotic division   d. mitotic division

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B Compare between :

1. positive acceleration – negative acceleration - in terms (Definition – final speed).
2. Focus of the convex mirror – focus of the concave mirror - in terms (cause of formation- the properties of image).

C A train starts to move at 7 o'clock in the morning then, What is the time of arriving if it moves with speed 100 Km/h to cut a distance of 500 Km.

Question **4**

A Rewrite the following statements after correcting the underline words :

1. Chromosomes arranged a long the cell equator in the **anaphase**.
2. Euglena can reproduce asexually by **budding**.
3. Radius of mirror curvature $= \frac{1}{2} \times$ Focal length.
4. When an object moves at acceleration equals zero, this means that its **acceleration is positive**.
5. If a light ray falls passing through the optical center of the convex lens, it exits passing **through the focus**.

B An object was placed in the middle between a convex lens whose **focal length** is 5 cm. and a plane mirror, the distance between them was 20 cm (as in the figure).

1. Find the distance between the image formed by the convex lens and the image formed by the plane mirror.
2. Mention the properties of the image formed by the convex lens.

C What happens in the following states :

1. Absence of centrosome from the animal cells.
2. The nebula lost its temperature in laplace's opinion.
3. Starfish losses on of its arms, while it contains a part of the central disc.

10 Kafr El-Sheikh Governorate

Answer the following questions :

Question **1**

A Complete the following statements :

1. Sexual reproduction depends on two main processes, which are .... and ....
2. The galaxy that contains most of the stars we see at night is named .... galaxy.
3. When the distance is measured in meter, the speed unit is measured in ....

4. The point that is in the middle of reflecting surface of the concave mirror is called ....

5. The first phase for a cell to enter mitosis is ....

B Rewrite the following statements after correcting the underline words :

1. The speed is called uniform when the object covers equal distances at **unequal** periods of time.

2. The solar system is composed of **seven** planets rotating around the sun.

3. The Hubble telescope was launched in an orbit around the earth at a height of **5000** km.

4. The image of an object formed in a **convex** mirror is upright and equal to the object.

Question 2

A Write the scientific term for each of the following :

1. A pair of connected threads at the centromeres in a chromosome.

2. The line that passes through the center of curvature of the mirror and its pole.

3. The displacement covered in a unit time ($\frac{\text{displacement (km or m)}}{\text{total time (hour or second)}}$)

4. The phenomenon of the light bouncing off in the same medium when it strikes a reflecting surface.

5. The ability of an animal to compensate its missing parts.

6. An eye disease because of old age that causes a difficulty of vision as a result of the darkness of the lens.

B Compare by giving definition between :

1. Asexual reproduction and sexual reproduction.

2. Scalar physical quantities and vector physical quantities.

Question 3

A Give reasons for :

1. Pilots take in consideration the velocity of winds when flying.

2. Sexual reproduction is a source of genetic variation.

B A car covered 500 meters westward within 40 sec, then only one kilometer northward within 100 sec, then 500 meters eastward within 60 sec to approach a fuel filling station.

Calculate the following :

1. The total distance covered by the car.

2. The total time taken to cover this tour.

3. The displacement from starting point to the filling station.

4. The velocity of the car.

5. The average speed of the car.

Question **4**

A Choose the correct answer :

1. Acceleration measurement unit is ....
   a. meter/sec   b. meter/sec^2 c. meter. Sec

2. The equipment which is used in studying the Sun spectra is ....
   a. hubble telescope   b. contact lenses   c. solar telescope

3. The .... contains genetic material from both parents and grow to form an individual carries characters from both parents.
   a. chromosome   b. zygote   c. gamete

4. The image formed by concave lens is always ....
   a. virtual and erect   b. real and magnified   c. real and diminished

5. An incident ray falls parallel to the principal axis of a concave mirror will reflect ....
   a. passing through the focus   b. passing through the center of curvature
   c. parallel to the secondary axis.

6. The founder of the nebular assumption is ....
   a. Laplace   b. Fred Hoyle   c. Molten

B What would happen when :

1. Putting a yeast fungus in a warm sugary solution.

2. A person who has long sightedness defect is using a convex lens while reading.

11 Behiera Governorate

Answer the following questions :

Question **1**
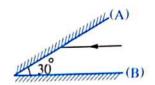
A Write the scientific term for each of the following statements :

1. The point inside the lens lies on the principal axis in the mid distance between its faces.

2. Asexual reproduction occurs by different parts of the plant without needing seeds.

3. A disease that infects the eye and causes a difficulty of vision because the eye lens becomes dark "opaque".

4. They are the arrangement of homologous pairs of chromosomes where each pair consists of 4 chromatids.

5. The acceleration by which an object moves when its final speed is less than its initial speed.

6. A flat gaseous rounded disk that formed the planets of the solar system.

B **Give reasons for :**

1. Pilots take in consideration the velocity of the wind during their flights.
2. The number of chromosomes is constant in the same species which reproduce sexually.

C **If a light ray fell on mirror (A) such that it was parallel to mirror (B) as in the opposite figure. Trace the path of the ray until its reflection on mirror (B), then Calculate the reflection angle of the light ray from the mirror (B).**

Question 2

A **Correct the underline words :**

1. When an object moves at uniform acceleration, this means that its speed is **zero**.
2. If the nucleus of pollen grain of a plant contains (10) chromosomes, so the nucleus of its leave's cell contains **(5) pairs** of chromosomes.
3. A moving car covers 200 kms in 150 min, its speed equals **90** km/hour.
4. Spores are found in the bread mould fungus inside special organs which are called **ovary**.
5. The shortest distance covered by a body in a certain direction is called the **speed**.
6. The scientist **Isaac Newton** published a research entitled "World Order" and that was in 1796.

B **What happen when ...... ?**

1. A moving body covers the same distance in half the time according to its speed.
2. Incidence of a light ray passing through the centre of curvature of concave mirror.

C **A body is placed at 8 cm from a surface of a convex lens is made of two surfaces of spheres, the diameter of each sphere is 16 cm, Show by drawing the distance between the object and its image and write the properties of the image.**

Question 3

A **Choose the correct answer :**

1. The line between the centres of curvature of the lens passing by the optical centre of the lens is called ....

   a. the focal length
   b. the principal axis
   c. the secondary axis
   d. the radius of curvature

2. The .... division occurs to produce sperms.

   a. mitotic in ovary
   b. meiotic in ovary
   c. mitotic in tests
   d. meiotic in tests

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3. In the opposite figure :
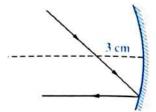
Radius of mirror curvature = ... cm.

a. 3   b. 6

c. 9   d. 12

3 cm

4. From unicellular organisms that reproduce by binary fission ....

a. amoeba and bacteria   b. paramecium and euglena
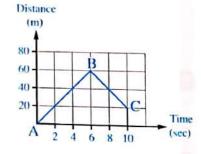
c. amoeba and paramecium   d. bacteria and simple algae

5. If the relative speed of a car is 20 km/hour relative to an observer moves at speed of 40 km/hour in the same direction, so the actual speed of this car is .... km/hour.

a. 20   b. 40   c. 60   d. 80

6. Our solar system is located in one of the .... arms of the Milky Way galaxy.

a. spiral   b. oval   c. straight   d. circular

B Mention the important of each of the following :

1. A convex mirror is put at the left side of the driver of the car.

2. Centrosome in the animal cell.

C The opposite graph represents the movement of a body from point (A) to point (C) passing by point (B)

Calculate the following :

1. Speed

2. Velocity

Distance (m)

80
60   B
40
20   C

A 2 4 6 8 10   Time (sec)

Question 4

A Complete each of the following :

1. Force is considered as .... physical quantity, while mass is considered as .... physical quantity.

2. The two gases which produced galaxies, stars and are the universe over millions of years are helium and hydrogen with a percentage of .... , ... respectively.

3. Velocity and displacement of an object are similar in .... and are differ in ....

4. Some somatic cells in the human body are not divided at all such as .... and others are divided under certain circumstances such as ....

5. The movement path may be .... , ... or combination of both.

6. Astronomers use special equipments centered on Earth as .... , or carried into space as .... in order to study the Sun.

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B A car speeds up from zero meter / second to 10 meter / second in (4) seconds, then it slows down to 5 meter / second in (2) seconds. Calculate :

1. The acceleration of the moving car in :
   (A) The first period.
   (B) The second period.
2. The time taken by the car to stop if it moves at the same rate of change in velocity in the second period.

C Study the opposite figures, then answer :

Mention the number of the figure that represent :

1. A scientific mistake. (..........)
2. Reduces the number of chromosomes to half. (..........)
3. Produces the compensation of the damaged cells and repairing cells of wound. (..........)
4. The variation of genetic traits among the individuals of the same species. (..........)

Cell division (1)
Cell division (2)
Cell division (3)

12 Ismailia Governorate

Answer the following questions :

Question 1

A Complete the following statements with suitable words :

1. The chromosome chemically consists of protein and .... called DNA, which carries .... of the living organism.
2. Acceleration is considered one of .... physical quantities, while time is considered one of .... physical quantities.
3. Real image is not formed by .... lenses, ... mirrors and plane mirrors.

B Compare between : Nebular theory and modern theory concerning the name of the scientist.

C A car moves from rest and its speed reaches 25 m/sec in 10 seconds :

1. Calculate the acceleration.
2. Mention the type of acceleration.

Question 2

A Write the scientific term for each of the following statements :

1. The regular speed by which the moving object moves to cover the same distance at the same period of time.

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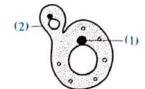
2. The length of the shortest straight line between two positions.

3. The cells formed from reproductive cell inside living organisms by meiotic division.

4. Disease infects the eye lens, so it becomes dark (opaque).

5. The force that controls in the orbits of planets around the Sun.

B When do this following happen ... ?

1. The relative speed of a moving object relative to an observer is more than its real speed.

2. The distance covered by a body equals the amount of displacement happened.

C The opposite figure shows a yeast fungus, answer :

1. What is the type of its asexual reproduction.

2. What happen to both (1) , (2) during the reproduction process.

Question 3

A Correct the underlined words :

1. Pilots take in consideration the **uniform speed** of the wind.

2. The long-sightedness is corrected by using a **concave mirror**.

3. The old stars gather in the **edges** of the galaxy.

4. In the rabbit cells, the spindle fibers are formed from **condensing the cytoplasm at the cell poles**.

5. When an object moving at a uniform acceleration, this means that its speed is **zero**.

B From the opposite figure in which position 1 , 2 or 3 is suitable to put the object to from :

1. Real, inverted and diminished image.

2. Virtual, upright and enlarged image at the same side of object.

3. No image.
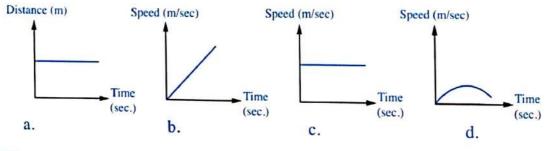
C What are the results when ..... ?

1. The incident light ray passes through the centre of curvature of the concave mirror.

2. Crossing over phenomenon occurs.

Question 4

A Choose the correct answer from the following :

1. Which of the following graphs describe the movement of an object at a constant speed.
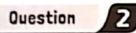
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2. .... lenses are used instead of glasses.

   a. Concave.   b. Convex.   c. Contact.   d. cylindrical.

3. The cells which are not divided at all are .... cells.

   a. adult red blood.   b. stomach.   c. liver.   d. skin.

4. The two gases which produced galaxies, stars and universe over millions of years are ....

   a. oxygen and helium.   b. helium and hydrogen.

   c. oxygen and hydrogen.   d. helium and nitrogen.

5. The cell is preparing to enter to meiotic division where the amount of the genetic material duplicates in .... phase.

   a. prophase 1   b. interphase.   c. metaphase 1.   d. Telophase 1.

B A hand-ball field in the form of a rectangle of 18 meters length and 3 meters width, what is the a mount of distance and displacement covered by a player moves around the field one complete cycle. :

C The figure in front of you shows one of the phase of a somatic animal cell division :

1. What is the name of this phase and the phase that precedes it ?
2. What type of division does this phase belongs to ?

13   Suez Governorate

Answer the following questions :

Question 1

A Choose the correct answer :

1. .... established the crossing star theory.

   a. Laplace   b. Alfred Hale   c. Hubble   d. Chamberlain

2. If an object is placed at a distance less than the focal length of concave mirror, a virtual, upright and .... image is formed.

   a. diminished   b. equal   c. magnified   d. real

3. The mirror that its reflecting surface is a part of the inner surface of a hallow sphere is a .... mirror.

   a. convex   b. diverging   c. converging   d. plane

4. Short-sightedness leads to collect rays .... the retina.

   a. in front of   b. behind   c. above   d. below

5. The change in speed in a unite time is called ....

   a. velocity.   b. average speed   c. displacement   d. acceleration

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B Look at the opposite figure then answer :

1. To which type of cell division it belongs ?

2. What is the name of this phase ?

3. What happens in this phase ?

C Compare between :

Positive acceleration and negative acceleration. (according to definition).

Question 2

A Write the scientific term :

1. The change of an object's position as the time passes according to a fixed point.

2. It contains all the galaxies, stars, planets and living organisms.

3. The speed of a moving body relative to a moving or a static observer.

4. Specialized cells which produce gametes.

5. The result of dividing the total covered distances that a moving object covers by the total periods of time taken to cover this distances.

B Give reasons for :

1. The force is a vector quantity.

2. The importance of the crossing over phenomenon.

3. The incident light ray which falls perpendicular on a plane mirror reflects on itself.

C Mention the conditions of occurrence for each of the following :

1. The reproduction by regeneration in starfish when it loses one of its arms.

2. The collection of the rays after being reflected from the concave mirror in the focus of the mirror.

Question 3

A Complete the following statements :

1. In Laplace's opinion, the nebula lost its sphere form and became in a form of a flat rotating disk under the effect of ....

2. The optical piece which forms laterally inverted image and equal to the body is called ....

3. The vegetative reproduction in plants occurs without the need of ....

4. In yeast, the bud emerges as a lateral bulge in the parental cell, then the cell nucleus is divided by .... division.

5. When the moving object covers equal distances at un equal periods of time this means that the body moves with .... speed.

B An object moves in a straight line with a uniform speed of 5 m/sec in the east direction for two seconds. Calculate :

1. The amount of the covered displacement through this period of time.
2. The covered distance through this period of time.
3. The acceleration of the moving object.

C Define each of the following :

- Fertilization.

2. The principal axis of the lens.

Question 4
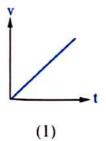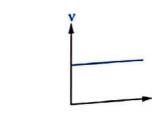
A Rewrite the following statements after correcting the underlined words :

1. Meiotic division occurs in flowering plants in the anther to produce **eggs**.
2. **The average speed** means that the object's speed changes by equal values through equal periods of time.
3. The theory that explained the origin of the **universe** is the modern theory.
4. **The gene** is the point of connection of the two chromatids of chromosome.
5. The number of chromosomes in the human liver cell is **quarter** the number of chromosomes in the female gamete.

B An object is placed at a distance of 5 cm. from convex lens its focal length is 2 cm.

Draw a diagram to show the path of rays that form the image of the object, showing the position and the properties of the image on the drawing only.
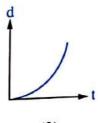
C From the following graphs :
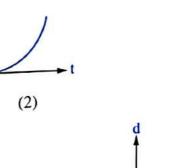
Determine **two graphs** represent the case of an object moves with acceleration does not equal Zero.
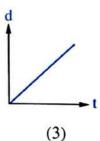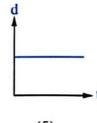
(1)

(2)

(3)

(4)

(5)

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(14) **Port Said Governorate**

Answer the following questions :

Question 1

A Choose the correct answer :

1. When an object moves with acceleration = zero this means that ....
   a. speed is changed
   b. speed of the body is constant
   c. acceleration increases
   d. body moves with deceleration.

2. The optical piece which forms equal, laterally inverted image of the body is ....
   a. convex lens   b. concave lens   c. spherical mirror   d. plane mirror

3. The two gases which produced galaxies, stars and universe through millions of years are ....
   a. oxygen and helium.
   b. oxygen and carbon dioxide
   c. hydrogen and helium.
   d. hydrogen and carbon dioxide

4. Meiosis division occurs in .... cells.
   a. liver   b. skin   c. bones   d. testis

B What is meant by :

1. Relative speed   2. Fertilization   3. Regeneration

C A car moves with speed 80 m/s. If the driver used the brakes to decrease the speed so it decreased by 2m/s². Calculate its speed after 12 seconds from using the breaks.

Question 2

A Complete the following sentences :

1. The movement path may be .... or .... or both of them.

2. The convex lens .... the light, while the convex mirror .... the light.

3. The scientist who establish the Nebula theory is .... , while the modern theory is established by .... scientist.

4. In plants, male gametes are called .... , while female gametes are called ....

B Draw a diagram to illustrate the image formed when the object is placed at a distance more than double the focal length in case of :

1. The concave mirror   2. The convex lens.

C Give reasons for :

1. Physicists use mathematical methods like graphs and tables.

2. Shrinking of spindle fibers during the anaphase of mitosis division.

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Question 3

A Rewrite the following statements after correcting the underlined words :

1. The incident light ray parallel to the principle axis of a concave mirror is reflected passing by the **curvature center** of the mirror.

2. The nuclei disappear during the mitosis cell division in **telophase**.

3. The solar system lies in **Andromeda** galaxy.

4. The scalar physical quantities are completely defined by its magnitude **and direction**.

B If the number of chromosomes in a human pancreatic cell is 23 pairs, what is the number of chromosomes in the following cells :

1. sperm.   2. fertilized ovum

C What do we mean by saying that :

1. A moving car covers a distance of 100 kilometers in two hours.

2. Angle of incidence of a light ray on to a plane mirror equals 20°.

Question 4

A Write the scientific term for each of the following statements :

1. It contributes in gens exchanging between the chromosome's chromatids and distributing them in the gametes.

2. The movement of galaxies away from each other in cosmic space.

3. A disease that infects the eye causing a difficulty in vision and the eye lens becomes opaque.

4. The displacement per one second.

B The displacement that covered by a moving body through different times are recorded in the following table :

Displacement (meter)	10	20	30	40	50	60
Time (second)	5	10	15	20	25	30

1. Represent the relation graphically.

2. Calculate the velocity from the graph.

C Compare between each of the following

1. Concave mirror and convex mirror.   (in terms of the method of obtaing a virtual image)

2. Reproduction by binary fission and reproduction by budding.
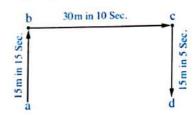
                        (in terms of giving examples for each of them)

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15 Fayoum Governorate

Answer the following questions :

Question 1

A Complete the following :

1. The building unit of universe is .... , and its number in universe is about ....
2. The result of multiplying a speed of a moving object by time = ... and mathematical relationship is ....
3. The focal length of a convex lens equals distance between .... and ....
4. The nucleolus and .... disappear at the end of .... of meiosis.
5. The movement path may be .... or ...., or a combination of each.

B What is meant by ?

1. Relative speed.   2. Fertilization.   3. Centromere.

C On a straight line there is a moving bus whose speed changes from 6 meters/second to 12 meters/second during a period of three seconds, **what is the amount of acceleration ?**

Question 2

A Choose the correct answer to complete the following statements:

1. A person walks for several minutes, then he runs for another several minutes, so his average speed is ....
   a. equal to final speed   b. greater than final speed
   c. less than final speed   d. equal zero

2. If a light ray falls passing the optical centre of the convex lens it leaves the lens ....
   a. Without refraction.   b. Parallel to the principal axis.
   c. Passing through centre of curvature   d. Passing through focus.

3. According to Big Bang, within minutes the universe was formed containing hydrogen and helium with ratio ....
   a. 75 : 1   b. 25 : 1   c. 3 : 1   d. 1 : 3

4. The parental individual disappear during reproduction by ....
   a. sporangium.   b. regeneration.   c. binary fission.   d. budding.

5. From physical quantities which needed to identify its magnitude and direction is ....
   a. the mass.   b. the force.   c. the density.   d. the area.

B Give reasons for each of the following :

1. Most of moving cars cannot move practically all time with uniform speed.

2. A convex mirror is put at the left and right side of driver.

3. Meiosis is considered as the source of genetic variation in living organisms.

C A body started its motion from (a) and covered 15 meters northward within 15 seconds, then 30 meters eastward within 10 seconds, and then 15 meters southward within 5 seconds as shown in the figure.

Find distance covered by a body, displacement and velocity.

Question 3

A Write the scientific term for each of the following statements :

1. The straight line that passes by the pole of the mirror and its centre of curvature.

2. The value of change of an object's speed in one second.

3. A flat rotating disk formed solar system.

4. A speed in which an object covers equal distances at unequal periods of time.

5. They are formed from cells known as reproductive cells in living organisms.

B What would happen in each of the following ..... ?

1. Putting a yeast fungus in a warm sugary solution.

2. The object covers the same distance in half time (according to its speed)

3. Reproductive cells don't divide by meiosis.

C Mention the properties of the image formed by concave mirror when the object is located between focus and center of curvature, explain with drawing.

Question 4

A Check (✓) in front of the right statements and (✗) in front of the false statements then correct the false ones :

1. The solar system is located in the Milky Way galaxy. ( )

2. Mitotic division occurs in somatic cells. ( )

3. The focus is the point that is in the middle of the reflective surface of the mirror. ( )

4. Displacement is the length of the longest straight line between two positions. ( )

5. Acceleration is a positive amount, if the object's speed increases by time. ( )

B (Metaphase – Prophase – Telophase – Anaphase) :

1. Arrange these phases according to the priority of occurrence.

2. Which type of division has these phases ?

C Compare between :

Long sightedness and short sightedness "according to lens used to treat".

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16 Beni-Suef Governorate

Answer the following questions :

Question 1
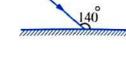
A Choose the correct answer :

1. If the chromosomal number in the somatic cell is 2 N, then its number in the reproductive cells is ....

   a. $\frac{1}{2}$ N   b. 4 N   c. 2 N   d. N

2. A light ray is incident on the surface of a plane mirror, as in the figure it reflects where the angle of incidence equal ....

   a. 40°   b. 50°
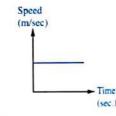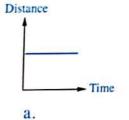
   c. 70°   d. 140°
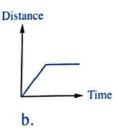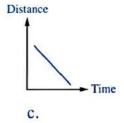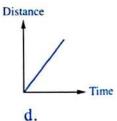
3. The optical piece that forms an equal and laterally inverted image of the body is the ....

   a. convex mirror   b. concave mirror   c. plane mirror   d. convex lens

4. According to the Big Bang theory the ratio of helium to hydrogen was ....

   a. 75 : 1   b. 25 : 1   c. 3 : 1   d. 1 : 3

5. The opposite graph represents the relation (speed – time) of a moving object, which of the following graphs represents the relation (distance – time) of the same moving object ....

   a.   b.   c.   d.

B What happens when ... ?

1. The nebula gradually lost its heat (concerning its size).

2. A moving object completes a complete cycle (concerning its displacement).

3. Incidence of a light ray parallel to the principal axis of a concave mirror (concerning its pathway).

C What is meant by each of the following :

1. The optical center of the lens.   2. Fertilization process.

Question 2
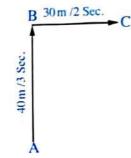
A Write the scientific term for each of the following :

1. It contains all the stars that we see at night in the sky.

2. The distance between the focus of the concave mirror and its pole.

3. The speed of a moving object relative to a constant or a moving observer.

4. The phase in which the cell is prepared for division.

5. The regular speed by which the object moves to cover equal distances at equal periods of time.

B Compare between each of the following :

1. Hydra and starfish (concerning the type of reproduction).

2. Male gamete and female gamete (concerning an example, for each of them).

3. Virtual image and real image (concerning its property, inverted or upright).

C The following figure represents the state of an object moves to the north from point (A) to point (B) where it covers 40 m through 3 sec, then it moves to the east from point (B) to point (C) where it covers 30 m through 2 sec.
Calculate each of the following :

1. Its speed.   2. Its velocity

B 30 m /2 Sec. → C

40 m /3 Sec.

A

Question 3
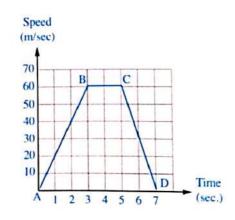
A Complete the following statements :

1. The center of mirror curvature in convex mirror lies .... the reflecting surface.

2. During the .... of mitotic division a series of adverse changes occur.

3. At the end of 1st. prophase of 1st. meiotic division, the phenomenon of .... occurs.

4. If an object starts its movement from rest, It means that its initial speed equal ....

B Study the following figure which represents the movement of an object, then answer the following :

1. What is the value of acceleration at which the body moves in the period (AB)

2. What is the type of acceleration at which the body moves in the period (CD)

3. Calculate the interval of time at which the body moves with acceleration = zero.

Speed (m/sec)

70
60 B   C
50
40
30
20
10   D   Time
A 1 2 3 4 5 6 7   (sec.)

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C Examine the opposite figure which represents one of the phases of cellular division, then answer the following :

1. What happens when the spindle fibers shrink in this phase ?
2. What are the changes that occur in the previous phase ?

Question 4

A Correct the underlined and rewrite the statements in your answer papers :
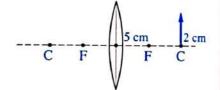
1. The measuring unit of **distance** is m/sec^2.
2. Some plants reproduce vegetatively by **seed.**
3. The chromosome chemically consists of DNA and **lipids**.
4. **Molten** used the phenomenon of stars explosion to develop his assumptions about evolution of the solar system.
5. If the regular speed of the car is 25 m/sec, this means that its speed equal **72** km/h.

B Give Reasons for :

1. Mass is a scalar physical quantity.
2. Using a convex lens for correcting long-sightedness.
3. The offspring have genetic traits identical to the parent in case of asexual reproduction.

C Study the following figure then answer the following :

1. Complete the path of the rays to form an image.
2. Complete the following :
   a. The length of the image = ... cm.
   b. The distance between the image and the optical center of the lens is .... cm.

17 Minia Governorate

Answer the following questions :

Question 1

A Choose the correct answer :

1. If a train moves with a speed 100 km/h it covers a distance 50 km in .... time.
   a. 5 hour   b. 0.05 hour   c. 2 hour   d. 0.5 hour

2. Mushroom is reproduced by ....
   a. regeneration   b. budding   c. sporogony   d. binary Fission

3. Within minutes from the Big Bang, the ratio of hydrogen was .... %.
   a. 100   b. 75   c. 50   d. 25

4. If you know that the focal length for a concave mirror equals 10 cm, so for getting a virtual image for an object, it must put at a distance from the mirror equals .... cm.

a. 20   b. 15   c. 10   d. 5

5. In the opposite figure, an object starts its movement from point (A) towards point (B) then It turn East to point (C) therefore the displacement for the object equals the length of ....
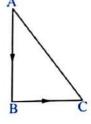
a. AB   b. AC
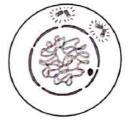
c. AB + BC   d. BC

B In the opposite figure :

1. What is the name of the phase which is represented by that figure ?
2. When does this phase occur ?
3. Why does the cell pass by this phase ?

C What is meant by :

1. Cataract   2. uniform acceleration

Question 2

A Complete the following statements by the suitable answer :

1. A car moves in a certain direction by a speed equals 80 Km/h, its speed appears 40 Km/h for an observer moves with a speed .... in .... direction of the car.
2. According to the modern theory, the cloud of gas was subjected to .... process forming moving planets.
3. Real image cannot be formed by .... lens or .... spherical mirror.
4. The chromosome chemically consists of .... and ....

B An object moves in a straight line and covers distance in different times, recorded in the following table :

Distance (meter)	10	20	30	40	50
Time (second)	4	8	12	16	20

1. Draw the graphic relationship for the values illustrated in the table ?
2. Calculate the value of speed by which the object moves ?

C What happens in the following Cases :

1. An incident light ray passing through the centre of curvature of a concave mirror.
2. Bulge is disconnected from the parental cell in the yeast fungus after it is fully grown.
3. Plane mirror is put on the left side of the car driver.

Question 3

A Write the scientific term for each statement :

1. A vision defect is formed as a result in the shortness of the radius of the ball thus the retina is close to the eye lens.
2. The covered displacement during the unit of time.
3. A unit is used to measure the distance between celestial bodies in the universe.
4. The process of exchange between the two inner chromatids.
5. It contains all the galaxies, stars, planets and living organisms.

B An object is put at a distance of 6 cm from the surface of a convex lens, its focal length is 2 Cm illustrate with drawing the position of the image for the object, state its properties.

C Compare between the following :

1. Sexual and asexual reproduction (genetic traits)
2. Scalar physical quantity and vector physical quantity (concept)

Question 4

A Correct the underline words in the following statements :

1. The speed of the car can be detected directly by using the **compus**.
2. **Centre of curvature** is the point that is in the middle of the reflecting surface of the mirror.
3. Chromosomes are arranged nearly along the cell equator in the **anaphase**.
4. The solar system is located in one of the **oval** arms of the Milky Way galaxy.

B A train moves with a speed of 20 m/s and when using the breaks it moves with deceleration $4m/s^2$. **Calculate** the time required to stop the train.

C Give Reason for :

1. In the plane mirror the image cannot be received on a screen.
2. The amount of fuel consumed during flying between two cities differs by the difference of the wind direction.

D State the importance of Nano gold particles in the medical field.

18 Assiut Governorate

Answer the following questions :

Question 1

A Choose the correct answer :

1. The ability of some animals to compensate their missing parts is called ....

   a. vital   b. reproduction   c. regeneration

2. When a body moves by acceleration equals zero this means that ....
   a. the body acceleration is increasing
   b. the body velocity is uniform (constant)
   c. The body velocity is variable.

3. If a person stands at 3 metre from a plane mirror so the distance between the person and his image in the mirror equals .... metre.
   a. 3
   b. 4
   c. 6

4. The two factors which can be used to describe the object's movement are ....
   a. distance and time
   b. speed and time
   c. area and time.

5. Scientists believe that the universe originated from a massive explosion and was in a (an) .... state.
   a. contraction then expansion   b. expansion then contraction
   c. continuous expansion

6. From the measuring units of speed ....
   a. m/s
   b. m × s
   c. m/s².
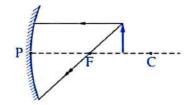
B Compare between :

Sexual reproduction and asexual reproduction in terms of :

The genetic traits of the resulted offspring.

C Draw the figure in your answer paper then complete :

1. the path of an object image light rays.

2. Mention the properties of formed image.

Question 2
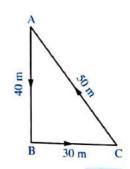
A Complete the following statements :

1. The point that lies in the middle of the reflecting surface of the concave mirror is called ....

2. The solar system is located in one of the .... arms of the Milky Way on the edge of the galaxy.

3. The vision defect which is due to the decrease of convexity of the eye lens (the eye ball diameter) surface is called ....

4. The spindle fibers are formed during the cell division in ....

5. **In the opposite figure :**

   A body starts its motion from point (A) to point (B), then to point (C) then returned to point (A), so the displacement covered equals ....

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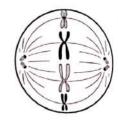
Ⓑ What happens when :

1. Incidence of a light ray by angle 60° on a plane mirror.

2. The nebula lost its temperature gradually in laplace's theory.

Ⓒ The opposite figure represents one of phase of a division in an animal somatic cell :

1. What is the kind of the division to which this phase belongs ?

2. What is the name of this phase ?

3. What are the changes occur in this phase.

Question 3

Ⓐ Write the scientific term for each of the following statements :

1. Cellular division which leads to the formation of gametes.

2. A division of the total covered distances by the moving object over the total periods time taken to cover these distances.

3. The straight line that joins between the two centres of curvature of the lens.

4. It contains all the stars which we can see in the sky at night.

5. A process in which some important vital operations occur which prepare the cell for division and the genetic material in the cell is doubled.
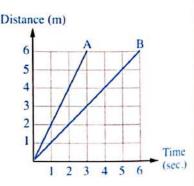
Ⓑ What is meant by :

1. The focal length of a concave lens is 7 cm.

2. An object moves with uniform acceleration equals 10 m/s^2.

Ⓒ The opposite graph represents the relation

(distance – time) for two moving bodies (A) and (B)

1. What is the kind of speed in which the two bodies move.

2. Which of them moves with a greater speed ? and why ?

3. Calculate the speed of a body (A).

Question 4

Ⓐ Put (✓) or (✗) then correct the wrong ones :

1. The founder of crossing star theory is Fred Hoyle.   (   )

2. The unicellular protozoans reproduce by binary fission.   (   )

3. An example of the scalar physical quantity is force.   (   )

4. The formed image by the plane mirror is real.   (   )

5. The chromosome consists of two chromatides connected together at centromere. (   )

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B Give reasons for :

1. The object that is placed at the focus of a convex lens has no image.
2. The continuous expansion of the space (universe).

C Show by an experiment how to determine the focal length of the concave mirror.

19 Sohag Governorate

Answer the following questions :

Question 1

A Write a suitable word to complete the following statements :

1. The two factors which can be used to describe the motion of a body are the .... and ....
2. Length of pen is 6 cm. this is .... physical quantity because it is enough to identify its .... only.
3. The distance of the object to the plane mirror .... the distance of its image to the mirror, and the straight line connecting the object and its image is .... on the surface of the mirror.
4. The Big Bang theory assumes the evolution of the .... , while the nebular theory assumes the evolution of the ....
5. Reproduction with .... occurs in unicellular protozoans, ... and bacteria.

B A car moved from rest and its speed reaches 25 m/s through 10 seconds.

1. Calculate the acceleration of the car.
2. What is a type of acceleration ?

C What is meant by .... ?

1. Sexual reproduction.
2. The focus of the convex lens.
3. The zygote.

Question 2

A Write the scientific term :

1. Angle of incidence equal angle of reflection.
2. Which have the main role in cell division.
3. Asexual reproduction occurs by using plant organs except seeds.
4. It contains the Sun and the solar system.
5. The actual length of the path that moving object takes from the starting point of movement to the end point of movement.

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B Give reasons for each of the following :

1. It is hard to obtain a regular speed practically.
2. The number of chromosomes is constant in the same species which reproduce sexually.
3. The lens has two focus while the spherical mirror has one focus.

C A car moves 40 m. northward within 35 sec. Then covered 80 m. eastward within 20 sec. Then covered 40 m. Southward within 25 sec.

Calculate :

1. The velocity of the car.
2. The average speed of the car.

Question 3

A Correct the underline words in the following statements :

1. During the meiosis division, the crossing over phenomenon occurs at the end of **anaphase 1**.
2. **Irregular speed** means that the object's speed change by equal values through equal periods of time.
3. The explosion of the star occurs as a result of **chemical** reactions that occurs suddenly and violently.
4. If two cars move in same direction. The first car moves at 80 m/s and second car moves at 90 m/s. The relative speed of the second car to first car equal **170 m/s**.

B A convex lens has a focal length equal 20 cm. an object is placed at a distance of 40 cm. from lens. :

1. Draw a diagram to show the path of the rays falling on the lens and refracted ones from it.
2. Mention the properties of the formed image.

C What happens when ..... ?

1. The centrosome is not found in the animal cell.
2. When a moving body returns back to its starting point concerning it's displacement.
3. The incidant light ray passing through the center of curvature of the concave mirror.

Question 4

A Choose the correct answer between the brackets :

1. Earliest life forms began to appear on Earth after about .... million years of the Big Bang.
   a. 3000   b. 12000   c. 15000   d. 17000
2. Focal length of the spherical mirror equal .... the radius of curvature of the mirror.
   a. double.   b. half.   c. quarter.   d. four time.
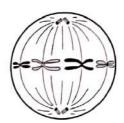
3. If the speed of a car is 72 k/hour, it's means that its speed equal .... m/s.

   a. 15   b. 20

                        c. 40   d. 70

4. When an object moves with acceleration = zero, this means the ....

   a. object's speed is changed.

                     b. object moves with positive acceleration.

   c. object moves with deceleration.

                     d. object's speed is constant.

B Compare between each of the following :

1. Long-sightedness and short-sightedness concerning the position of the formed image.
2. Mitosis division and Meiosis division concerning number of resulting cells at the end of division.
3. Crossing star theory and modern theory concerning the founder.

C The figure in the front of you shows a phase of cell division. Answer the following :

1. What is the type of this division ?
2. What is the name of this phase ?
3. What is the importance of this type of division ?

(20) Qena Governorate

Answer the following questions :

Question 1

A Choose the correct answer :

1. The radius of curvature of a spherical mirror equals .... of its focal length.

   a. double   b. half   c. quarter   d. four times

2. Meiosis division happens in the cells of the ....

   a. liver   b. skin   c. two testes   d. bones

3. **In the opposite figure,** a body starts its motion from point (A) to point (B) then to point (C), then returned to point (A), so the distance covered equals .... meter(s).

   a. zero   b. 50

   c. 70   d. 120

4. The solar system contains the Sun and .... planets revolving around it.

   a. 7   b. 8   c. 9   d. 10

5. The real image is formed by ....

   a. concave mirror   b. convex mirror   c. concave lens   d. plane mirror

6. The number of galaxies in the universe is about .... million galaxies.

   a. 100   b. 1000   c. 10 thousands   d. 100 thousands

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B **What is meant by :**

1. The pole of the mirror.   2. Fertilization.

C **A car moved with speed 50 m/s. If the driver used the breaks to decrease the speed, so it decreases by 2 m/s². Calculate its speed after 12 seconds from using the breaks.**

Question **2**

A **Complete the following sentences :**

1. .... theory assumed that the origin of the solar system was from the explosion of the expanded part of the Sun due to a huge star approached to it.
2. The result of multiplying a speed of a moving object by time = ...
3. The chromosome chemically consists of .... and ....
4. Earliest life forms began to appear on Earth after about .... years from the Big Bang.
5. The reflecting surface of the convex mirror is a part of .... surface of the sphere.
6. Time is from the examples of .... physical quantities.

B **What is meant by each of the following ?**

1. The average speed of a moving car is 60 km/hour.
2. Angle of reflection of the light ray = 40°

C **The opposite figure represents one of the phases of the mitosis division :**

1. What is the name of this phase ?
2. What happens in this phase ?

Question **3**

A **Put (✓) or (✗) in front of the following sentences :**

1. The movement of the train is considered examples of moving in one direction.   (   )
2. Asexual reproduction in the yeast fungus occurs by spores.   (   )
3. The object speed increases by decreasing the time needed to cover the same distance.

    (   )
4. Galaxies move away in the cosmic space.   (   )
5. The contact lenses can put (stick) to the eye iris and can be removed easily.   (   )
6. The measuring unit of displacement is second × meter.   (   )

B **An object is put at a distance of 3 cm from a concave mirror, its focal length is 5 cm :**

1. Draw a diagram to show the path of the rays falling on the mirror and the path of the rays that are reflected from it.
2. Mention the properties of the formed image.

C Mention one importance for each :

1. Centrosome in the animal cell.

2. Hydrogen and helium

(according to the Big Bang theory)

Question 4

A Write the scientific term for each of the following sentences :

1. The speed of the moving object relative to a constant or a moving observer.

2. A flat gaseous round disk that formed the planets of the solar system.

3. The straight line that passes by the pole of the mirror and its center of curvature.

4. The ability of some animals to compensate their missing parts.

5. The force that controlled the orbits of planets around the Sun according to the modern theory.

6. Displacement covered through a unit time.

B Compare between each of the following :

1. Uniform speed and non-uniform speed.   (according to definition).

2. The thick convex lens and the thin convex lens.   (according to the focal length).

C Give reasons for :

1. Sexual reproduction is a source of genetic variation.

2. The concave lens is used to correct the short-sightedness.

(21) Luxor Governorate

Answer the following questions :

Question 1

A Complete the following :

1. When an object moves at an acceleration equals zero, this means that the speed of the object is ....

2. The diameter of the thin lens is .... that of the thick lens.

3. The ability of some living organisms to compensate their missing parts is known as ....

4. According to the crossing star theory, the origin of the solar system was ....

5. The mass of cells produced due to the abnormal continuous division of cells is called ....

B What happens if ...... ?

1. The moving body takes double the time to cover half the distance according to its speed.

2. Crossing over phenomenon doesn't occur.

3. A light ray passes through the optical centre of the lens.

C An object is placed at a distance of 15 cm from a spherical mirror with radius of curvature 15 cm and when the mirror is displaced 3 cm. toward the object, an image for the object is formed on a screen - Determine the position of the formed image, write the properties of the formed image and explain by drawing.

Question **2**

A Choose the correct answer for each of the following :

1. In the opposite figure :

   the ratio between the speed of the two objects ($\frac{A}{B}$)
   , approximately is ....
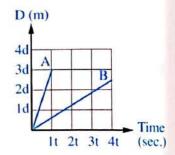
   a. $\frac{9}{2}$ b. $\frac{9}{4}$

   c. $\frac{3}{2}$ d. $\frac{9}{3}$

2. The Earliest life forms began to appear on Earth ....

   a. before the formation of galaxies.

   b. after the formation of the solar system.

   c. after the appearance Dinosaurs.

   d. after the appearance of birds and mammals.

3. On putting an object at a distance 11 cm from a convex lens optical centre, a real inverted magnified image was formed and when putting it at distance 13 cm, a real inverted diminished image was formed, so the expected value of the focal lens is ....

   a. 10 cm   b. 9 cm   c. 6 cm   d. 12 cm

4. The reproduction by budding occurs in .... fungus.

   a. mushroom   b. yeast   c. bread mould   d. starfish

5. A car takes 4 sec. to reach 9 times its initial speed, so the car moves with acceleration which its numeric value equals .... of initial speed.

   a. quarter   b. half   c. three times   d. double

B A body moves in straight line with speed 3 m/sec for 30 m distance, then he move on the same line for 120 m with a speed 6 m/sec. Calculate the average speed for this body from the beginning of the movement to the end ?

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ⓒ Give reasons for :

1. Asexual reproduction keeps the genetic structure of the living organism.
2. (Distance – Time) graph of an object that moves at a uniform speed is a straight line passing through the origin point.

Question 3

Ⓐ Write the scientific term for each of the following :
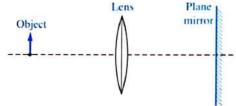
1. The change in the position of an object by the time passes according to the position of another object.
2. The point of collection of the rays which incident parallel to each other and parallel to the principal axis of the concave mirror.
3. Sacs are carried by a lot of fungi and contain a large number of spores.
4. Glowing of a star for short time to become one of the most shining stars in the sky, then its glowing disappears gradually to return as it was.
5. The fusion of male gamete and the female gamete to form zygote.

Ⓑ In the opposite figure :

An object is placed in front of a convex lens and put on the other side a plane mirror, when we look in the mirror, we find that no image is formed for the object, :

1. Mention the position of the object from the lens.
2. Why no image is formed for the object inside the mirror.

ⓒ Two cells are divided in a plant, one of them in the stem and the other in the ovary, if you know the number of chromosomes in each of them is 8 pairs of chromosomes, mention :

1. The kind of cell division in each cell.
2. The type of reproduction in this plant.
3. The number of chromosomes in each resulted cell.

Question 4
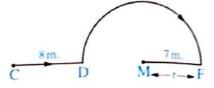
Ⓐ Correct the underline words :

1. **Plane mirror** converges the light rays.
2. From the theories that more acceptable between scientists in explaining the origin of the universe is **the modern theory**.
3. Gametes in living organisms are produced from a special cells known as **somatic cells**.
4. The relative speed of a moving car relative to an observer at rest is **less than** the real speed.
5. The speed of car can determine directly by using **the compass**.

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B In the opposite figure :

An object is moving from point (C) to point (M) passing

By two points (D , F) in (5 sec.), **calculate :**

1. The covered distance   2. The velocity.

C Compare between :

1. Reproductive cell and Gamete   (according to the division).

2. Distance and displacement   (according to definition).

22   Aswan Governorate

Answer the following questions :

Question 1

A Complete the following :

1. A long-sighted person needs a medical eye glasses with a .... lens.

2. If the body moves from rest so, its initial speed equals ....

3. The scientist Laplace founded the .... theory to explain the origin of the solar system.

4. The spindle fibers are formed from .... in animal cell.

B Mention the type of asexual reproduction for each of the following :

1. Sponges.   2. Starfish.

C A car moves with speed 80 m/sec. If the driver used the breaks to decrease the speed so, it decreases by 2 m/sec². Calculate its speed after 12 seconds from using the breaks.

Question 2

A Choose the correct answer :
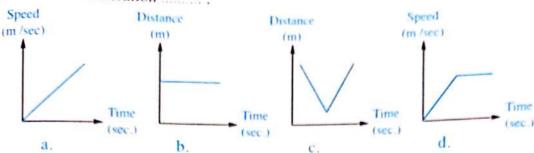
1. The number of chromosomes in each somatic cell and the sperm of the living organism in respectively is .... chromosomes.

   a. 6 , 12   b. 5 , 6   c. 8 , 8   d. 12 , 6

2. The glowing and explosion of stars as the Sun due to ....

   a. chemical reaction   b. nuclear reaction   c. burning of gases   d. flammable gases

3. If an object is placed at a distance more than the twice of the focal length from convex lens its focal length 5 cm and the image which formed of an real, inverted and smaller at a distance .... cm.

   a. 3   b. 5   c. 8   d. 10

4. Which of the following graphical relation represents the movement of an object at a uniform acceleration ....

Speed (m /sec)	Distance (m)	Distance (m)	Speed (m /sec)
Time (sec.)	Time (sec.)	Time (sec.)	Time (sec.)
a.	b.	c.	d.

B Give reasons for :

1. The moving car with a certain speed seems to be at rest, to a moving observer with the same speed and in the same direction.

2. No image is formed for an object placed in the focus of convex lens.

C Mention one importance for :

1. The nuclear acid DNA in chromosome.

2. Speedometer in cars and planes.

Question 3

A Write the scientific term :

1. The covered straight distance by moving object in a constant direction.

2. Asexual reproduction by using plants organs except seeds.

3. A theory explains the origin of the universe due to emerged from the particles of helium and hydrogen gases, since 15000 million years.

4. It has genetic material from both parents and during growth gives a new offspring carries the traits of both parents.

B What happen in the following cases :

1. If an incident light ray passes through the optical center of the lens.

2. If a moving body covered the same distance in a double time "according to its speed".

C Show by drawing only :

The formation of the image of an object at the center of curvature of a concave mirror.

Question 4

A Correct the underlined words :
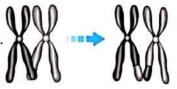
1. **Real** image cannot be received on a screen.

2. The time is a **vector** physical quantity.

3. The **crossing star** is the largest star that can be seen from the surface of Earth.

4. In the **anaphase**, chromosomes arranged at the middle of the cell.

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B When the following values equals zero :

1. The acceleration of a moving body.
2. The angle of reflection of a light ray from the reflecting surface of a plane mirror.

C The opposite figure represents a biological phenomenon :

1. What is the name of this phenomenon ?
2. Mention the name of this phase which this phenomenon occurs.
3. Mention the kind of division which this phase belongs to.
4. What is the importance of this phenomenon occurrence ?

(23) Red Sea Governorate

Answer the following questions :

Question 1

A Write the scientific term for these sentences :

1. An area where the two chromatid connect together.
2. The displacement happens in one second.
3. A unit used to measure the distance between galaxies in space.
4. The ability of some animals of compensate the missing parts.
5. The straight line pass with the centre of curvature of concave mirror and any point on its reflecting surface except it pole.

B What is the result on each of the following :

1. Put plane mirror on the left of the car driver instead of convex mirror.
2. Movement body with regular speed to its acceleration.
3. The movement of galaxies with regular motion.

C A car move with speed 130 m/s, the speed decelerate with 5 m/s^2 when the driver use the breaks. Calculate the car speed after 20 seconds from the moment of using the breaks.

Question 2

A Complete the following sentences :

1. The .... division happens in .... cells to form the gametes.
2. The focus of concave mirror in the middle distance between .... , ...
3. The atomic particles merged to form .... , ... gases which form the galaxies and stars.
4. The body move 15 m east then opposite the direction 10 m west, so the distance equal .... metre, and the displacement equal .... metre.

B Correct the underline words :

1. Measure the relative speed of the moving object depend on **the time.**

2. The reproduction in yeast fungi completed with **spores.**

3. The theory of **stars explosion** depend on finding something looks like clouds or nebula in space.

4. **The focus** is a point inside the lens lies on the principal axis of the lens.

C Write the function of :

1. The central body in the animal cell (centrosome).

2. Contact lenses.

Question 3

A Give scientific correct reason :

1. The interphase occur before the cellular division.

2. We use the convex lens to correct the long-sightedness.

3. The explosion of some stars suddenly.

4. The motion of the train from example of the motion in one direction.

B What mean with each of the following :

1. Fertilization.

2. The crossing over phenomenon.

3. The distance between optical center and real focus of convex lens is 20 cm.

C If the number of chromosome in a gamete of an animal are 22 chromosome, what is the number of chromosomes in the cell of :

1. The zygote.   2. The testis.   3. The ovum.

Question 4

A Choose the correct answer :

1. The source of genetic vartion is .... reproduction.

     a. vegetative   b. asexual   c. sexual   d. binary fission

2. The two factor describe the body motion are .... , ...

     a. distance and displacement   b. velocity and mass

     c. acceleration and time   d. distance and time.

3. The nucleolus and nuclear membrane appear in the ....

     a. telophase   b. anaphase   c. metaphase   d. prophase 1

4. From the physical vector quantity is ....

     a. the length   b. the force

     c. the volume   d. the distance

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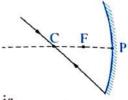
5. The reflected angle of light ray in this figure equal ....

    a. Zero°   b. 30°

    c. 45°   d. 90°
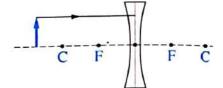
6. The body between the focus and pole of the concave mirror its image is ....

    a. real diminished   b. real magnified   c. virtual magnified   d. virtual diminished

Ⓑ What is the difference between each of the following :

Asexual reproduction and sexual reproduction according to the hereditary trait of the resulting individual.

Ⓒ From the opposite figure :

1. What is the type of lens.
2. Complete the light rays after drawing in your answer sheet to form the image.

24 North Sinai Governorate

Answer the following questions :

Question 1
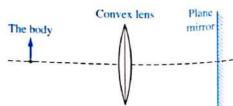
Ⓐ Complete the following statements :

1. The secondary axis of the mirror is any straight line that passes .... and any point on its reflecting surface except ....
2. Sexual reproduction depends on two main process : .... and ....
3. Within minutes of the Big Bang, the atomic particles merged together producing .... and ...., which over the years produced galaxies, stars and the universe.
4. Force is considered as .... quantity, while the mass is considered as .... quantity.

Ⓑ Give reasons for :

1. The motion of the metro considered as a motion in one direction.
2. Meiotic division is called reduction division.

Ⓒ An object placed in front of a convex lens and placed a plane mirror in front of them.

When you look inside the mirror you find that there is no image formed.

1. Determine the location of the body relative to the lens.
2. Why didn't the body image formed inside the plane mirror ?

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Question 2
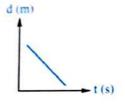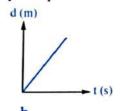
A Choose the correct answer :
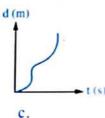
1. The speed of a car 120 km/h .... a car speed 40 m/s.
   a. equal to
   b. less than
   c. higher than

2. In the opposite figure, a body starts its motion from point (A) and stopped at point (C) passing by the point (B), the amount of body displacement equals : ....
   a. the length AB+BC
   b. the length BC
   c. the length AC

3. The parent individual disappears during reproduction in ....
   a. the yeast
   b. the bread mould
   c. the bacteria

4. .... theory has assumed that the Sun is the origin of the solar system.
   a. Big Bang
   b. Crossing star
   c. Alfred Hale

5. Which of the following graphs represent a body moves at zero acceleration.

   a.
   b.
   c.

6. The real image is always ....
   a. inverted
   b. upright
   c. smaller

B Compare between :
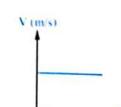
1. Animal cell and plant cell (concerning formation of spindle fibers)
2. Distance and displacement (according to definition).

Question 3

A Correct the underlined words :
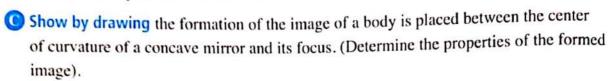
1. Relative speed of a car relative to an observer in another car if they were moving in the same direction at a same speed of 100 m/sec is equal to **200 m/sec**.
2. The opposite graph represents a body **at rest**.
3. The crossing over phenomenon occurs in the first **anaphase** of first meiosis.
4. The **uniform speed** is the speed in a given direction.
5. The solar system lies in **Andromeda** galaxy.
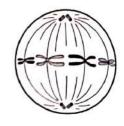
B The following figure represents a cell during its division answer the following :

1. The figure represents .... of .... division.
2. Give reason for your answer.
3. What is the phase that follows it ?

C **Show by drawing** the formation of the image of a body is placed between the center of curvature of a concave mirror and its focus. (Determine the properties of the formed image).

Question 4

A Write the scientific term :
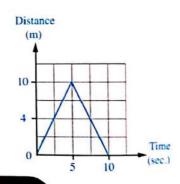
1. The regular speed by which the object moves to cover equal distances at same period of time.
2. A flat gaseous round disk that formed the solar system.
3. The ability of some animals to compensate their missing parts.
4. The image that cannot be formed on a screen.

B What happens when :

1. The diameter of the eye becomes longer than a certain length.
2. The nucleus of the cell is removed.

C In the opposite shape, calculate :

1. The total distance.
2. The value of velocity within the first 5 seconds.

(25) South Sinai Governorate

Answer the following questions :

Question 1
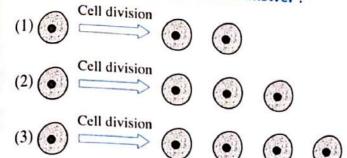
A Write the scientific term for each of the following :

1. The connected point of two chromatid.
2. A point in the middle of the lens, lies at the principal axis in the mid distance between its two faces.
3. Located in one of the spiral arms of the Milky Way galaxy.
4. The ability of some animals to compensate their missing parts.
5. The displacement in one second.

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B Study the following figure then answer :

Cell division

(1)

Cell division

(2)

Cell division

(3)
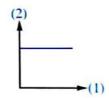
1. Which figure has a scientific mistake ?

2. Mention the type of division in the other two correct figures.

C A train began a journey its length 200 km at 6 am with speed 40 km/h. What is the time of its arrival ?

Question 2

A Give reasons for the following :
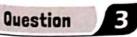
1. Vegetative reproduction of grape plant not produce new genetic properties.

2. It is hard to obtain regular speed practically.

3. The mass is a scalar quantity, but the force is a vector quantity.

B In the following graph, mention the name of horizontal axis (1) and vertical axis (2).

object move with acceleration = Zero

C Correct the underlined words :

1. The distance of the object to the plane mirror **more than** the distance of its image to the mirror.

2. The cell produced from fertilization process is named by **tetrad groups**.

3. The real image is always **upright**.

4. **Light refraction** is the bouncing the incident light ray in the same medium when it strikes a reflecting surface.

Question 3
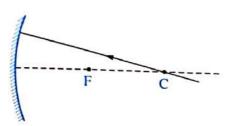
A Choose the correct answer :

1. In the opposite figure, the angle of reflection of the light ray equal ....

   a. 90°

   b. 45°

   c. Zero

   d. 30°

203
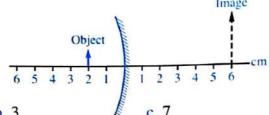
2. Meiosis occurs in the .... cells.

a. liver   b. skin   c. bones   d. testis

3. Spindle fibers begin to shrink at..........

a. prophase   b. telophase   c. metaphase   d. anaphase

4. Paramecium is unicellular protozoan reproduce by ....

a. spores   b. budding   c. regeneration   d. binary fission

5. **In the following figure,** an object put in front of a concave mirror, a virtual upright magnified image is formed. What is the focal length of this mirror ? .... cm.

a. 2   b. 3   c. 7   d. 6

B **What is the results of the following :**

1. A huge star approached the Sun according to the crossing star theory.

2. Elongation in the ball diameter of the eye ball.

C **An object is put at 5 cm of a convex lens, its focal length 3 cm, show by drawing the position and the properties of the formed image.**

Question 4

A **Put (✓) or (✗) for the following :**

1. Measuring unit of speed is sec/meter.   ( )
2. Fred Hoyle assumed the crossing star theory.   ( )
3. Relative speed is the speed of the moving object relative to an observer.   ( )
4. Gametes in living organisms are produced by special cells known as the somatic cells during the meiosis division.   ( )
5. The universe originated when the atomic particles merged together producing oxygen and nitrogen gas.   ( )

B **An object starts its motion from rest with regular acceleration can be calculated from the relation ($a = \frac{10}{t}$) :**

1. Find the final speed of the object.

2. Mention the type of regular acceleration.

C **Mention the importance of the following :**

1. Speedometer in cars and planes.   2. Nuclear acid DNA.

26 The New Valley Governorate

Answer the following questions :

Question 1

A Choose the right answer from the given choices :

1. The .... is the physical quantity that both its magnitude and direction are necessary for identifying it.

   a. quantity of matter   b. scalar quantity   c. vector quantity

2. If the train moves at 100 km/hour, it covers a distance of 40 km in .... hour.

   a. 0.3   b. 0.4   c. 0.5

3. The scientist .... published a research entitled "world order" which included his vision about nebular forming the solar system.

   a. Chamberlain   b. Laplace   c. Fred Hoyle
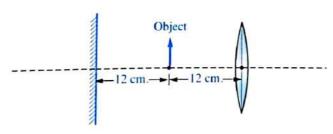
4. .... reproduction is a source of genetic variation.

   a. Budding   b. Regeneration   c. Sexual

B Mention the measuring unit of the following :

1. Mass   2. Velocity

C In the following figure, an object is placed in the mid distance between a convex lens which has a focal length of 6 cm and a plane mirror :

1. mention the properties of the image formed by the convex lens.

2. Calculate the distance between the image of an object formed by the convex lens and that formed by the plane mirror.

Question 2

A Complete the following sentences :

1. The vision defect which is due to a shortness in the radius of the eye ball is called .... and it is corrected by using ....

2. The two necessary factors for describing the movement of an object are .... and ....

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3. The spindle fibers in the animal cell is formed from .... , but in the plant cell the spindle is composed from .... at the cell poles.

4. The chromosome consists of .... connected at ....

B Compare between :

1. The crossing star theory and the modern theory of the world according to :

   a. the scientist who based the theory

   b. the origin of the solar system.

Compare	Crossing star theory	Modern theory
The scientist who based the theory	....	....
The origin of the solar system	....	....

2. The real image and the virtual image according to : their properties.

Compare	Real image	Virtual image
Properties of the image	....	....

C If you know that a cell in your body divided twice producing four cells. Answer the following :

a. What is the type of division occurring in this cell ?

b. Does the number of chromosomes in the produced cells from this division change ? Why ?

Question 3

A Write the scientific term for each of the following :

1. The speed of moving object relative to the moving or constant observer.

2. The actual length of the path that the moving object takes from the starting point of the movement to the end point.

3. A phase in which some important biological processes occur to prepare the cell for division and the genetic material in the cell duplicates.

4. The point of the collection of the parallel rays which fall parallel to each others and parallel to the principle axis of the concave mirror.

B Mention the importance of :

1. The speedometer in cars and planes.

2. The nuclear acid DNA.

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c A car moved from rest and its speed increased to 10 m/sec in 4 seconds, then the car's speed decreased to 5 m/sec in 2 seconds. Calculate :

1. The acceleration with which the car moved during :
   a. the first period

   b. The second period

2. Time needed to stop the car if it moved in the same rate of change in speed in the second period.

Question 4

A Correct the underline words :

1. Contact lenses are put on the **eye pupil** and can be easily removed.
2. Violent sudden **chemical** reactions occur in the star resulting in its explosion.
3. Sporogony occurs in **starfish**.
4. The radius of curvature of the mirror equals **a half ($\frac{1}{2}$)** of the focal length.

B Give reasons for :

1. mitosis is opposite to meiosis as it is important to children.
2. The convex lens is known as a converging lens, while the concave lens is known as a diverging lens.
3. The moving cars in certain speed seems constant relatively to an observer that is in the same speed and direction.

C Explain by drawing the crossing over phenomenon then mention its role in the variation of genetic traits among the individuals of the same species.

(27) Matrouh Governorate

Answer the following questions :

Question 1
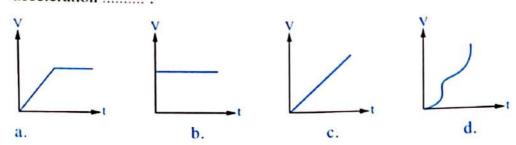
A Choose the correct answer from those given :

1. To obtain the virtual, equal and up-right image, we use .... mirror.
   a. concave　　　b. plane　　　c. convex　　　d. all of the previous

2. The scientist who established the modern theory about the evolution of the solar system is ....
   a. Chamberlain　　b. Archimedes　　c. Fred Hoyle　　d. Laplace

3. If the number of chromosomes in a liver cell of a living organism is (32), then the number of chromosomes in the male gamete is .... chromosomes.
   a. 64　　b. 16 pairs　　c. 16　　d. 32

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4. Which of the following graphical relations represent the moving of body by uniform acceleration ....

a.   b.   c.   d.

5. If $\overline{V} \neq V$ this motion is described as a .... motion.

a. regular   b. irregular   c. positive   d. negative

B An object is placed at distance 30 cm from the convex lens its focal length 25 cm, show by drawing the path of the ray and the properties of its image.

C What is meant by :

1. Vegetative reproduction.   2. The principal axis of the mirror.

Question 2

A Write the scientific term for each of the following :

1. The type of cell division leads to the formation of gametes.
2. Groups of stars that rotate together in the space by the effect of the gravity.
3. The speed of a moving object relative to an observer.
4. It is a point inside the lens lies on the principal axis.
5. It is the change of an object position as time passes according to position of another object.
6. Seeing far objects clearly and seeing the near objects distorted.

B A runner covered 50 meters northward within 30 seconds, 100 meters eastward within 60 seconds, then 50 meters southward within 10 seconds. Calculate :

1. Average speed.   2. Average velocity.

C Compare between each of the following :

1. Budding and regeneration.   (Give example)
2. Real image and virtual image.   (Definition)

Question 3

A Complete the following :

1. Bread mould fungus reproduces by ....
2. The spindle fibers is composed in the plant cell from .... at the cell poles.
3. An object is placed at the focus of a convex lens, it forms ....

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4. If the object at rest moves regularly until its speed reaches 12 m/sec. after three seconds. So the acceleration equals ....

5. The product of velocity of body X time = ...

B **According to the Big Bang theory, rearrange the following events from the oldest to the nearest :**

1. Sun was born and Earth and the planets were created.

2. Ancestral galaxies were evolved.

3. Earliest life forms began to appear on Earth.

4. Matter got joined in mass.

C **What happen when ..... ?**

1. A light ray is incident by an angle 90° on a plane mirror.

2. The gravity between Sun and the planets rotate around is vanished.

3. The final speed of a moving body is greater than its initial speed.

Question 4

A **Give reasons for each of the following :**

1. The force and displacement are considered vector physical quantities.

2. The lens has two centers of curvature but spherical mirror has one center of curvature only.

3. Sexual reproduction is considered as source of genetic variation among individuals.

4. A moving car seems to be at rest relative to the rider of another moving car beside it, at the same speed and direction.

B **From the opposite figure :**

1. What is the name of this phase ? and which type of cell division it belongs ?

2. Describe what happens in this phase ?

C **Correct the underline words :**

1. A spherical mirror whose diameter is 40 cm, so its focal length equal **20** cm.

2. The universe emerged from the particles of **oxygen and nitrogen**.

3. Meiosis results in the formation of **two** cells, each contains half the genetic material of the parental cell.

4. **Relative speed** is the actual length of the path that a moving object takes from the starting point of movement to the end point.

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1   **Cairo Governorate**

Answer the following questions :

Question 1

Ⓐ Complete the following sentences :

1. Acceleration is considered one of .... physical quantities, while time is considered one of .... physical quantities.

2. The solar system is located in one the .... arms of the Milky Way on the edge of the galaxy.

3. Somatic cells are divided by ...., while reproductive cells are divided by ....

Ⓑ What is meant by the following :

1. The optical centre of the lens.   2. Irregular speed.   3. Fertilization.

Ⓒ A car starts to move from rest in straight line, its speed reaches 12 m/sec. after 4 sec. Calculate the acceleration of the car, and what is the type of this acceleration.

Question 2

Ⓐ Choose the correct answer :

1. Yeast fungus reproduces asexually by ....
   a. regeneration.   b. binary fission.   c. budding.   d. spore.

2. The solar system consists of the Sun and .... planets revolve around it.
   a. 7   b. 8   c. 9   d. 10

3. The image formed by .... is always virtual, erect and small.
   a. convex lens   b. concave mirror
   c. plane mirror   d. convex mirror and concave lens

4. The speed of a moving object relative to the observer is considered as .... speed.
   a. regular   b. average   c. vector   d. relative

5. If an object at a distance of 3 metres from a plane mirror. The distance between that object and its image is .... metre.
   a. 3   b. 6   c. 9   d. 12

Ⓑ Explain by drawing :

The formed image by convex lens, when the body at a distance greater than double the focal length. Then write the properties of the formed image.

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C Give reasons for the following :

1. Some persons have short-sightedness.
2. Asexual reproduction in living organisms produces individuals identical in genetic structure to those of their parent.

Question 3

A Re-write the following statements after correcting the underlined words :

1. The chromosomes chemically consists of nuclear acid called (DNA) and **fats**.
2. If the radius of curvature of a concave mirror equals 20 cm. its focal length will be **30** cm.
3. In meiotic cell division, Crossing over phenomenon occurs at the end of **anaphase 1**.
4. The scientist **laplace** assumed the modern theory about the origin of solar system.
5. In Telophase of mitosis cell division, two new separate cells are formed, each cell has **half** number of chromosomes of mother cell.
6. Concave lens **converges** the light rays that falling on its surface.

B What would happen in the following cases :

1. If the starfish loses one of its arms containing a part of its central disc.
2. If the incident light ray falls parallel to the principal axis of concave mirror.

C Mention the measuring unit for the following :

1. The mass.   2. Vector velocity.

Question 4

A Write the scientific term for the following :

1. The total distance that a moving object covers divided by total time taken to cover this distance.
2. The object's speed changes (increases or decreases) by equal values through equal periods of times.
3. The space which contains all the galaxies, stars, planets, moons and living organisms.
4. A biological process, where the living organism produces new individuals of the same kind and thus, ensuring its continuity.
5. The distance moved through a unit time.
6. The angle between the incident light ray and the perpendicular line on the reflecting surface from the point of incidence.

B Compare between the following :

1. Distance and displacement (according to definition).
2. Real image and virtual image.

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2 Giza Governorate

Answer the following questions :

Question 1

Ⓐ **Complete the following statements :**

1. In Milky Way galaxy, the old stars (the older) gather in the .... of the galaxy.

2. Parental individual disappears when reproduction occurs in ....

3. The incident light ray that passes through the focus of the convex lens, it exits from the lens ....

4. Mass is considered from .... physical quantity.

Ⓑ **Give reasons for :**

1. The body which moves at acceleration can't move at a regular speed.

2. Shrinking of spindle fibers during the anaphase.

Ⓒ **Compare between :** Pollen grain and sperm according to (site of formation).

Question 2

Ⓐ **Choose the correct answer :**

1. Within minutes of Big Bang, hydrogen gas was formed by a percentage of .... %.

   a. 25   b. 50   c. 75   d. 100

2. If the number of chromosomes in liver cells of a certain living organism is (32) chromosomes then the number of chromosomes in ovum cell is ....

   a. 8   b. 16   c. 24   d. 32

3. The optical piece which forms laterally inverted (reversed) image and equal to the body is ....

   a. convex lens   b. concave lens   c. spherical mirror   d. plane mirror.

4. A train moves at a speed (100 km/h), then it cover a distance of (40 km) within time .... hours.

   a. 0.3   b. 0.4   c. 0.5   d. 0.6

Ⓑ **When do the following happen ... ?**

1. Formation of real image at the same position of the object which is placed in front of a concave mirror.

2. The displacement equal (identical) to the distance for moving body.

Ⓒ **Calculate the actual speed of the car whose relative speed is (80 km/h) relative to an observer moving in opposite direction at a speed of (30 km/h).**

Question 3

A Write the scientific term for each of the following :

1. A theory assumed that the solar system was originally a glowing gaseous sphere revolving around itself.

2. The nucleic acid that carries the genetic traits of the living organism.

3. A mirror, always forms a diminished image for the object.

4. The displacement in one second.

B Define : 1. Tetrad.   2. The focal length of a lens.

C An object is placed at a distance of (8 cm) from a concave lens has a focal length (2 cm) :

1. Draw the direction of the ray that eye sees the image.

2. Mention the properties of image formed.

Question 4

A Correct the underlined words :

1. Sudden violent **chemical** reactions occur within the star which led to its explosion.

2. Reproduction by sporogony occurs in **starfish**.

3. The long-sightedness is corrected by using **concave mirror**.

4. A moving car covers a distance of (200 kilometer) through (150 min.), then its speed is **90** km/h.

B What is meant by ... ?

1. A moving car covers a distance of 100 km in two hours.

2. Zygote.

C A train moves at a speed (30 m/sec). And when the brakes is used it moves with a decelerating (3 m/sec^2). Calculate the time taken to stop the train.

3   Alexandria Governorate

Answer the following questions :

Question 1

A Complete the following statements :

1. The solar system lies on one of the spiral arms of .... galaxy.

2. From the scalar physical quantities is ...., while .... is from the vector physical quantities.

3. Condensing the cytoplasm in the two poles of the plant cells forms ....

4. Crossing over phenomenon happens between the .... during the meiosis division.

B 1. Copy the figure then draw the rays that form the image of the object.

2. The point (X) refers to ....

C What is meant by the followings ... ?

1. Fertilization.

2. The radius of curvature of a mirror.

Question 2

A Choose the right answer :

1. When a moving object covers equal distances in unequal intervals of time, so it moves by ....

   a. average speed.   b. relative speed.   c. uniforms speed.   d. irregular speed.

2. The scientist who published a research including his vision about the Nebular assumption ....

   a. Chamberlin.   b. Laplace.   c. Fred Hoyle.   d. Molten.

3. An object was put at 10 cm from a concave mirror, a real, inverted and equal image was formed, if the object moved 3 cm towards the mirror, so the formed image will be ....

   a. real, inverted and diminished.   b. real, inverted and enlarged.

   c. virtual diminished.   d. virtual enlarged.

4. An observer in a moving car with 80 km/h was observing a moving car with 90 km/h in the same direction so, the observed speed of the 2nd car is ....

   a. 10 km/h.   b. 80 km/h.   c. 90 km/h.   d. 170 km/h.

B What are the results of the followings ... ?

1. Falling of parallel peam of light parallel to the principal axis of a convex lens.

2. The meiosis division inside the anther and the ovary of a flower.

C Name the phase that indicates the following changes during the cell division :

1. Form two separate groups of chromatids.

2. Disappearing of the nucleolus and the nuclear membrane.

Question 3

A Write the scientific term for the following :

1. Groups of stars gathered in distinctive shape.

2. The ability of some animals to compensate their missing parts.

B The next graph illustrates the movement of a car, study it and answer the following :

1. The driver used the break for the first time at the .... second when the speed value was .... m/sec.

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2. Calculate the acceleration of the car through 4 seconds from the starting point.

C Compare between long-sightedness and short-sightedness concerning the concept and the treatment.

Question 4

A Correct the underlined parts in the following :

1. Amoeba reproduces by **budding**.

2. The formed image of an object that is put at **the centre of curvature** for a convex lens is virtual enlarged.

B Give reasons for the following :

1. The sporangium of bread mould fungus must be ruptured during reproduction.

2. The merging of atomic particles that happened during the Big Bang produced stars and the universe.

C Look at the following figures and answer :

1. Which of the two figures express the formation of F letter image.

2. The other figure is wrong because .... and ....

Figure (1)   Figure (2)

4 Kalyoubia Governorate

Answer the following questions :

Question 1

A Write the scientific term for each of the following statement :

1. The point of connection of the two chromatids in a chromosome.

2. The line that passes through the optical centre of the lens without passing through the two centres of curvature of its faces.

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3. The distance between the pole of a spherical mirror and its center of curvature.

4. It's the Sun and eight planets revolving around it.

5. The speed of a moving body that covers equal distances at unequal time intervals.

B What is meant by ... ?

1. The value of the length of the shortest straight line between two positions = 5 m.

2. The relative speed.

3. Spindle fibers during cell division.

C A person moves in the path (a b c d e) as shown in figure, he covered a distance of 10 m. northward in 2 seconds, then he covers 30 m. eastward in 10 seconds. and followed by 40 m. southward in 8 seconds, finally 30 m. westward in 5 sec.

1. Calculate the displacement of the person from the start of motion to end.

2. In which part of the person motion, his speed was the least ?

Question 2

A Choose the correct answer :

1. The .... is the phase in which the cell is prepared for division by doubling the genetic material.

   a. prophase   b. interphase   c. metaphase   d. anaphase

2. A concave mirror has a focal length of 8 cm. An object is placed in front of this mirror forming an image at a distance 20 cm from the mirror. This means that the object is placed at .... from the mirror.

   a. 8 cm.   b. less than 8 cm.

   c. 20 cm.   d. more than 8 cm. and less than 16 mc.

3. A doctor advised a person who has a sight defect to use glasses with convex lenses. It means that this person suffers from ....

   a. a decrease in the convexity of the eye lens surface.

   b. an increase in the convexity of eye lens surface.

   c. an increase in the eyeball diameter.

   d. disability of seeing far objects clearly.

4. Reproduction by spores occurs in all the following organisms, except ....

   a. starfish.   b. fungus.   c. bread mould.   d. mushroom.

5. One of the vector physical quantities is ....

   a. time of a car trip.   b. length of a pen.

   c. mass of a cat.   d. force by which person pushes a stone.

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Ⓑ In the figure shown, an object is placed at the centre of curvature of one face of a convex lens of focal length 6 cm. Then, a plane mirror is placed at the other side of the object at 8 cm. from the object. Copy the diagram in your answer sheet and answer :

1. Draw the path of light rays incident on the lens to form an image on a screen in front of the lens.

2. Calculate the distance between the two images formed by the lens and the mirror.

Ⓒ The figure in front of you shows a phase of cell division. Answer the following :

1. What is the type of this division ?

2. What is the name of this phase ?

3. What is the importance of this type of division ?

Question 3

Ⓐ Put (✓) in the front of correct statements and (✗) in front of the wrong ones :

1. The solar system includes several galaxies. ( )

2. If the angle between the incidence ray and the reflected ray is 60°,
   the angle between the reflected ray and the reflecting surface is 60°. ( )

3. The displacement of an object is measured in m/sec. ( )

4. An assumption of the crossing star theory is that a star revolves near the Sun. ( )

5. Bread mould fungus reproduces by binary fission. ( )

Ⓑ Give reasons for the following :

1. Meiotic cell division is called reduction division.

2. A donor for a part of the liver suffers no harm and can survive.

Ⓒ A car moved from Banha to Cairo at a distance of 40 km in 30 minutes, then it returns back from Cairo to Banha in the same time. Calculate (in km/h) :

1. The car velocity from the beginning to the end of the journey.

2. The average speed of the car during the total time.

Question **4**

Ⓐ What would happen in each of the following ... ?

1. Absence of anther from the floral plants.
2. To the value of velocity of a moving object if the time of the same displacement is increased to double.
3. The organization and arrangements of stars in the galaxy were changed.
4. Focusing laser on the gold Nano-particles in the cells infected by cancer.
5. A light ray is incident passing through the center of curvature of a concave mirror.

Ⓑ Mention the properties of the formed image in each of the following cases :

1. An object is placed in front of a convex mirror.
2. An object is placed in front of a convex lens at a distance less than its focal length.
3. An object placed at the focus of a convex lens.

Ⓒ A car speeds up from 0 m/s to 10 m/s in 4 seconds, then it slows down to 5 m/s in 2 seconds. Calculate :

1. The acceleration of the moving car in the first stage and the acceleration of the moving car in the second stage.
2. The time taken by the car in the second stage to stop if it moves at the same rate of velocity change.

Final Examinations 2019

1 Cairo Governorate

Answer the following questions :

Question 1

A) Complete the following sentences :

1. Acceleration is considered one of .... physical quantities, while time is considered one of .... physical quantities.

2. The solar system is located in one the .... arms of the Milky Way on the edge of the galaxy.

3. Somatic cells are divided by ...., while reproductive cells are divided by ....

B) What is meant by the following :

1. The optical centre of the lens.   2. Irregular speed.   3. Fertilization.

C) A car starts to move from rest in straight line, its speed reaches 12 m/sec. after 4 sec. Calculate the acceleration of the car, and what is the type of this acceleration.

Question 2

A) Choose the correct answer :

1. Yeast fungus reproduces asexually by ....
   a. regeneration.   b. binary fission.   c. budding.   d. spore.

2. The solar system consists of the Sun and .... planets revolve around it.
   a. 7   b. 8   c. 9   d. 10

3. The image formed by .... is always virtual, erect and small.
   a. convex lens   b. concave mirror
   c. plane mirror   d. convex mirror and concave lens

4. The speed of a moving object relative to the observer is considered as .... speed.
   a. regular   b. average   c. vector   d. relative

5. If an object at a distance of 3 metres from a plane mirror. The distance between that object and its image is .... metre.
   a. 3   b. 6   c. 9   d. 12

B) Explain by drawing :

The formed image by convex lens, when the body at a distance greater than double the focal length. Then write the properties of the formed image.

C Give reasons for the following :

1. Some persons have short-sightedness.

2. Asexual reproduction in living organisms produces individuals identical in genetic structure to those of their parent.

Question 3

A Re-write the following statements after correcting the underlined words :

1. The chromosomes chemically consists of nuclear acid called (DNA) and **fats**.

2. If the radius of curvature of a concave mirror equals 20 cm. its focal length will be **30** cm.

3. In meiotic cell division, Crossing over phenomenon occurs at the end of **Anaphase 1**.

4. The scientist **laplace** assumed the modern theory about the origin of solar system.

5. In Telophase of mitosis cell division, two new separate cells are formed, each cell has **half** number of chromosomes of mother cell.

6. Concave lens **converges** the light rays that falling on its surface.

B What would happen in the following cases :

1. If the starfish loses one of its arms containing a part of its central disc.

2. If the incident light ray falls parallel to the principal axis of concave mirror.

C Mention the measuring unit for the following :

1. The mass.   2. Vector velocity.

Question 4

A Write the scientific term for the following :

1. The total distance that a moving object covers divided by total time taken to cover this distance.

2. The object's speed changes (increases or decreases) by equal values through equal periods of times.

3. The space which contains all the galaxies, stars, planets, moons and living organisms.

4. A biological process, where the living organism produces new individuals of the same kind and thus, ensuring its continuity.

5. The distance moved through a unit time.

6. The angle between the incident light ray and the perpendicular line on the reflecting surface from the point of incidence.

B Compare between the following :

1. Distance and displacement (according to definition).

2. Real image and virtual image.

2 Giza Governorate

Answer the following questions :

Question 1

A Complete the following statements :

1. In Milky Way galaxy, the old stars (the older) gather in the .... of the galaxy.

2. Parental individual disappears when reproduction occurs in ....

3. The incident light ray that passes through the focus of the convex lens, it exits from the lens ....

4. Mass is considered from .... physical quantity.

B Give reasons for :

1. The body which moves at acceleration can't move at a regular speed.

2. Shrinking of spindle fibers during the anaphase.

C Compare between : Pollen grain and sperm according to (site of formation).

Question 2

A Choose the correct answer :

1. Within minutes of Big Bang, hydrogen gas was formed by a percentage of .... %.
   a. 25   b. 50   c. 75   d. 100

2. If the number of chromosomes in liver cells of a certain living organism is (32) chromosomes then the number of chromosomes in ovum cell is ....
   a. 8   b. 16   c. 24   d. 32

3. The optical piece which forms laterally inverted (reversed) image and equal to the body is ....
   a. convex lens   b. concave lens   c. spherical mirror   d. plane mirror.

4. A train moves at a speed (100 km/h), then it cover a distance of (40 km) within time .... hours.
   a. 0.3   b. 0.4   c. 0.5   d. 0.6

B When do the following happen ... ?

1. Formation of real image at the same position of the object which is placed in front of a concave mirror.

2. The displacement equal (identical) to the distance for moving body.

C Calculate the actual speed of the car whose relative speed is (80 km/h) relative to an observer moving in opposite direction at a speed of (30 km/h).

Question 3

A Write the scientific term for each of the following :

1. A theory assumed that the solar system was originally a glowing gaseous sphere revolving around itself.

2. The nucleic acid that carries the genetic traits of the living organism.

3. A mirror, always forms a diminished image for the object.

4. The displacement in one second.

B Define : 1. Tetrad.   2. The focal length of a lens.

C An object is placed at a distance of (8 cm) from a concave lens has a focal length (2 cm) :

1. Draw the direction of the ray that eye sees the image.

2. Mention the properties of image formed.

Question 4

A Correct the underlined words :

1. Sudden violent **chemical** reactions occur within the star which led to its explosion.

2. Reproduction by sporogony occurs in **starfish**.

3. The long-sightedness is corrected by using **concave mirror**.

4. A moving car covers a distance of (200 kilometer) through (150 min.), then its speed is **90** km/h.

B What is meant by ... ?

1. A moving car covers a distance of 100 km in two hours.

2. Zygote.

C A train moves at a speed (30 m/sec). And when the brakes is used it moves with a decelerating (3 m/sec²). Calculate the time taken to stop the train.

3 ◁ Alexandria Governorate ▷

Answer the following questions :

Question 1

A Complete the following statements :

1. The solar system lies on one of the spiral arms of .... galaxy.

2. From the scalar physical quantities is ...., while .... is from the vector physical quantities.

3. Condensing the cytoplasm in the two poles of the plant cells forms ....

4. Crossing over phenomenon happens between the .... during the meiosis division.

B 1. Copy the figure then draw the rays that form the image of the object.

2. The point (X) refers to ....

C What is meant by the followings ... ?

1. Fertilization.
2. The radius of curvature of a mirror.

Question 2

A Choose the right answer :

1. When a moving object covers equal distances in unequal intervals of time, so it moves by ....

   a. average speed.   b. relative speed.   c. uniforms speed.   d. irregular speed.

2. The scientist who published a research including his vision about the Nebular assumption ....

   a. Chamberlin.   b. Laplace.   c. Fred Hoyle.   d. Molten.

3. An object was put at 10 cm from a concave mirror, a real, inverted and equal image was formed, if the object moved 3 cm towards the mirror, so the formed image will be ....

   a. real, inverted and diminished.   b. real, inverted and enlarged.

   c. virtual diminished.   d. virtual enlarged.

4. An observer in a moving car with 80 km/h was observing a moving car with 90 km/h in the same direction so, the observed speed of the 2nd car is ....

   a. 10 km/h.   b. 80 km/h.   c. 90 km/h.   d. 170 km/h.

B What are the results of the followings ... ?

1. Falling of parallel peam of light parallel to the principal axis of a convex lens.

2. The meiosis division inside the anther and the ovary of a flower.

C Name the phase that indicates the following changes during the cell division :

1. Form two separate groups of chromatids.

2. Disappearing of the nucleolus and the nuclear membrane.

Question 3

A Write the scientific term for the following :

1. Groups of stars gathered in distinctive shape.

2. The ability of some animals to compensate their missing parts.

B The next graph illustrates the movement of a car, study it and answer the following :

1. The driver used the brake for the first time at the .... second when the speed value was .... m/sec.

2. Calculate the acceleration of the car through 4 seconds from the starting point.

Speed (m/sec.)

40
30
20
10
0

2 4 6 8

Time (sec.)

C Compare between long-sightedness and short-sightedness concerning the concept and the treatment.

Question 4

A Correct the underlined parts in the following :

1. Amoeba reproduces by **budding**.

2. The formed image of an object that is put at **the centre of curvature** for a convex lens is virtual enlarged.

B Give reasons for the following :

1. The sporangium of bread mould fungus must be ruptured during reproduction.

2. The merging of atomic particles that happened during the Big Bang produced stars and the universe.

C Look at the following figures and answer :

1. Which of the two figures express the formation of F letter image.

2. The other figure is wrong because .... and ....

प.-------------F
◄—— 5cm. ——►◄—— 5cm. ——►

Figure (1)

मुं.----------------F
◄———— 10cm. ————►◄—— 5cm. ——►

Figure (2)

4 El-Kalyoubia Governorate

Answer the following questions :

Question 1

A Write the scientific term for each of the following statement :

1. The point of connection of the two chromatids in a chromosome.

2. The line that passes through the optical centre of the lens without passing through the two centres of curvature of its faces.

3. The distance between the pole of a spherical mirror and its center of curvature.

4. It's the Sun and eight planets revolving around it.

5. The speed of a moving body that covers equal distances at unequal time intervals.

B **What is meant by ... ?**

1. The value of the length of the shortest straight line between two positions = 5 m.

2. The relative speed.

3. Spindle fibers during cell division.

C **A person moves in the path (a b c d e) as shown in figure, he covered a distance of 10 m. northward in 2 seconds, then he covers 30 m. eastward in 10 seconds. and followed by 40 m. southward in 8 seconds, finally 30 m. westward in 5 sec.**

1. Calculate the displacement of the person from the start of motion to end.

2. In which part of the person motion, his speed was the least ?

Question 2

A **Choose the correct answer :**

1. The .... is the phase in which the cell is prepared for division by doubling the genetic material.

   a. prophase   b. interphase   c. metaphase   d. anaphase

2. A concave mirror has a focal length of 8 cm. An object is placed in front of this mirror forming an image at a distance 20 cm from the mirror. This means that the object is placed at .... from the mirror.

   a. 8 cm.   b. less than 8 cm.

   c. 20 cm.   d. more than 8 cm. and less than 16 mc.

3. A doctor advised a person who has a sight defect to use glasses with convex lenses. It means that this person suffers from ....

   a. a decrease in the convexity of the eye lens surface.

   b. an increase in the convexity of eye lens surface.

   c. an increase in the eyeball diameter.

   d. disability of seeing far objects clearly.

4. Reproduction by spores occurs in all the following organisms, except ....

   a. starfish.   b. fungus.   c. bread mould.   d. mushroom.

5. One of the vector physical quantities is ....

   a. time of a car trip.   b. length of a pen.

   c. mass of a cat.   d. force by which person pushes a stone.

B In the figure shown, an object is placed at the centre of curvature of one face of a convex lens of focal length 6 cm. Then, a plane mirror is placed at the other side of the object at 8 cm. from the object. Copy the diagram in your answer sheet and answer :

1. Draw the path of light rays incident on the lens to form an image on a screen in front of the lens.

2. Calculate the distance between the two images formed by the lens and the mirror.

C The figure in front of you shows a phase of cell division. Answer the following :

1. What is the type of this division ?

2. What is the name of this phase ?

3. What is the importance of this type of division ?

Question 3

A Put (✓) in the front of correct statements and (×) in front of the wrong ones :

1. The solar system includes several galaxies. ( )

2. If the angle between the incidence ray and the reflected ray is 60°, the angle between the reflected ray and the reflecting surface is 60°. ( )

3. The displacement of an object is measured in m/sec. ( )

4. An assumption of the crossing star theory is that a star revolves near the Sun. ( )

5. Bread mould fungus reproduces by binary fission. ( )

B Give reasons for the following :

1. Meiotic cell division is called reduction division.

2. A donor for a part of the liver suffers no harm and can survive.

C A car moved from Banha to Cairo at a distance of 40 km in 30 minutes, then it returns back from Cairo to Banha in the same time. Calculate (in km/h) :

1. The car velocity from the beginning to the end of the journey.

2. The average speed of the car during the total time.

Question 4

A What would happen in each of the following ... ?

1. Absence of anther from the floral plants.

2. To the value of velocity of a moving object if the time of the same displacement is increased to double.

3. The organization and arrangements of stars in the galaxy were changed.

4. Focusing laser on the gold Nano-particles in the cells infected by cancer.

5. A light ray is incident passing through the center of curvature of a concave mirror.

B Mention the properties of the formed image in each of the following cases :

1. An object is placed in front of a convex mirror.

2. An object is placed in front of a convex lens at a distance less than its focal length.

3. An object placed at the focus of a convex lens.

C A car speeds up from 0 m/s to 10 m/s in 4 seconds, then it slows down to 5 m/s in 2 seconds. Calculate :

1. The acceleration of the moving car in the first stage and the acceleration of the moving car in the second stage.

2. The time taken by the car in the second stage to stop if it moves at the same rate of velocity change.

5 El-Sharkia Governorate

Answer the following questions :

Question 1

A Choose the correct answer :

1. If the uniform speed of a car is (90 km/h). This means that the car covers a distance equals .... metres in 40 sec.

   a. 1000   b. 2000   c. 2600   d. 4000

2. A light ray that falls on a plane mirror as in the figure it reflects, where the angle of reflection equals ....

   a. 30°   b. 60°   c. 90°   d. 50°

3. The person with normal vision sees the near objects clearly at a distance not less than ....

   a. 2 cm.   b. 25 cm.   c. 6 m.   d. 10 m.

4. The ratio between the final speed and the initial speed of an object moves at an accelerating motion is ....

    a. more than 1.   b. less than 1.   c. equal to 1.   d. equals to zero.

5. The earliest life forms began to appear on the Earth after .... million years from the Big Bang.

    a. 3000   b. 12000   c. 15000   d. 17000

B Define each of the following :

1. Reproduction by sporogony (spore propagation).

2. Fertilization.   3. Average speed.

C A train starts to move at 6 O'clock in the morning. Then what is the time of arrival if it moves at speed of 40 Km/h to cover the distance of 200 Km.

Question 2

A Write the scientific term for each of the following :

1. The speed of a moving object relatively to a constant or a moving observer.

2. The mirror, whose reflecting surface is a part of the inner surface the sphere.

3. It contains the Sun and the solar system.

4. Asexual reproduction takes place in some plants without needing seeds.

5. A point inside the lens that lies on the principal axis in the mid distance between its faces.

B Give reasons for :

1. The object that is placed at the focus of a convex lens has not an image.

2. (Distance – Time) graph of an object that moves at uniform speed is a straight line passing through the origin point.

3. Asexual reproduction in living organisms produces individuals identical in genetic structure.

C In the opposite figure :

An object was placed between a convex lens whose focal length is 6 cm. and a plane mirror.

1- Complete the following statements :

    a. The image formed of the object by a plane mirror at a distance of .... cm. from it's surface.

    b. The image formed of the object by a convex lens at a distance of .... cm. from it's face

    c. The distance between the image of the object which is formed by a convex lens and the image which is formed by a plane mirror equal .... cm.

2- Show by drawing the formed image by the convex lens.

Question **3**

(A) Complete the following sentences :

1. In human and animals, meiosis occurs in .... to produce the male gametes, while it occurs in .... to produce the female gametes.

2. Physicists use mathematical relations like .... and .... to predict the relation between certain physical quantities.

3. The vision defect which is due to the decrease in the eyeball diameter is called .... and is corrected by .... lenses.

4. The two factors which can be used to describe the motion of a body are the .... and ....

5. The chemical structure of the chromosome is .... and ....

(B) Compare between :

1. The real image and the virtual image.

2. Crossing star theory and modern theory
   (according to the name of scientist and the origin of the solar system).

(C) Show by drawing and write down the labels :

Interphase in mitosis division.
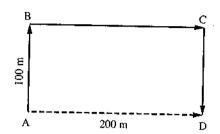
Question **4**

(A) Correct the underlined words :

1. The spindle fibers are formed in the plant cell from the **centrosome**.

2. The car which begins its movement from rest, moves at **uniform speed**.

3. Chromosomes are arranged at the middle of the cell in the **telophase.**

4. Contact lenses can stick to **eye iris** and can be removed easily.

5. **Acceleration** is the actual length of the path that a moving object takes from the starting point of movement to the end point.

(B) 1. Show by drawing and write short notes about : Prophase 1 in the first meiotic division.

2. Show by drawing : The relation between (speed – time)

Number of trail	Distance (d) in metre	Time (t) in second	Speed V = d/t (m/s)
1	0.4	5	0.08
2	0.6	7.50	0.08
3	0.8	10	0.08
4	1.0	12.50	0.08

C In the opposite figure :

Two cars moved at the same time from (A) to (D),
the first car takes the pass (ABCD) in 20 sec.
and the second car takes the pass (AD)
with regular speed 20 m/sec.

1. Which of the two cars reach first to point (D).

2. Calculate the velocity of the first car.

6 El-Menofia Governorate

Answer the following questions :

Question 1

A Choose the correct answer :

1. The ratio between initial speed and final speed for a moving object by increasing accelerations is ....

   a. more than one.   b. less than one.   c. equal to one.   d. equal zero.

2. A short sighted person sees the far objects distorted as their images formed ....

   a. on the retina.   b. behind the retina.   c. in front of the retina.   d. in front of the lens.

3. From examples of the scalar physical quantities is ....

   a. the velocity.   b. the mass.   c. the force.   d. the acceleration.

4. The cell that never divide is ....

   a. adult red blood cells.   b. the stomach.
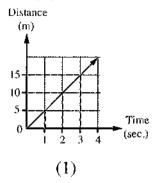
   c. the liver.   d. the skin.
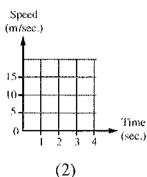
5. Paramecium is a protozoan that reproduces by ....

   a. spores.   b. budding.   c. regeneration.   d. binary fission.

B When each of the following values equal "Zero" :

1. Reflecting angle of a light ray incident on a plane mirror.

2. The velocity of a moving object.

3. Reflecting angle for an incident ray falls on reflecting surface of a cancave mirror.

C The following graphs represent the motion of two trains :

Distance (m) ... Time (sec.)
(1)

Speed (m/sec.) ... Time (sec.)
(2)

1. Describe the motion of the train in figure (2) ?

2. Calculate the speed of the train in figure (1) ?

Question 2

A Write the scientific term for each :

1. Asexual reproduction occurs by different parts of the plant without seeds.

2. A point inside the lens lies on the principal axis in the mid distance between its faces.

3. Are formed of reproductive cell inside living organisms by meiotic division.

4. Is the speed of the moving object relative to the observer.

5. A series of adverse changes occur which lead to the formation of a complete set of chromosomes that have the same number of the mother cell's chromosomes.

B 1. According to your study, copy the following table in your answer sheet and complete it by two applications of (LASER) in our practical life.

(The user)

The application	Who benefits of the application	The importance of the application
1st		
2nd		

2. An object moved (8) meters to east then (5) meters to west, determine :

The magnitude and the direction of the object's displacement ?

C A thin walled glass sphere its diameter (42 cm.) A suitable part of it was cut. its inner surface was the reflecting surface :

1. What is the type of the mirror produced in the cut part ? find its focal length ?

2. By drawing only show properties of the image formed by using the cutting part of the sphere if an object placed at a distance of (10 cm.) of its pole ?

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Question **3**

A Correct the underlined words :

1. The clear vision for a normal vision person remains, if the object comes closer at a distance not less than **60 cm**.

2. The ratio of number of cells produced due to the 3rd division to number of cells produced due the 2nd division equals $\left(\dfrac{6}{2}\right)$.

3. A phase where some important biological processes occur to prepare the cell for division is called **prophase**.

B Give reasons for :

1. The force is a vector quantity.

2. Wind direction may affect the amount of consumed fuel by the airplane between two cities in going flight than return.

3. Uniform speed for a car hard to done practically.

4. Crossing over phenomenon is an important factor in genetic variation among individuals of the same species.

5. Every galaxy has a definite shape differs of other galaxies.

C A moving car by a uniform speed covers (80) meters in (4) seconds. Then the driver press the brakes, so it stopped after other (4) seconds. Find :

1. The magnitude of the acceleration within 1st (80) meters.

2. The magnitude of the acceleration after pressing the brakes.

Question **4**

A Complete the following by suitable words :

1. Velocity and displacement of an object are similar in .... and for the measuring units they are ....

2. The result of dividing the total distance over the total time to cover it is equal .... and it is equal .... if the object moves by it. The object covers the same distance in the same time.

3. The Big Bang theory explain the origin of ...., while the nebular theory is one of the theories which explain the origin of ..

4. In animal cell spindle fibers formed from ...., while in plant cell spindle fibers form .... at the poles.

B Compare between :
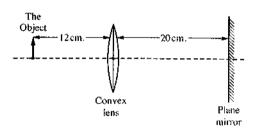
1. The crossing star theory and the modern theory.

(in term of the scientist developing the theory)

2. Sexual reproduction and asexual reproduction. (in term of properties of the offsprings)

C In the figure convex lens formed an image for the object at its left side at a distance of (12 cm), and this image is (real – inverted – equal to the object) in front of a reflecting surface of a plane mirror a way of the lens (20 cm).

Conclude each of the following :

1. Focal length of the convex lens.

2. The distance between the object and the image formed by the plane mirror ?

is the image upright or inverted for the object ?

7 El-Gharbia Governorate

Answer the following questions :

Question 1
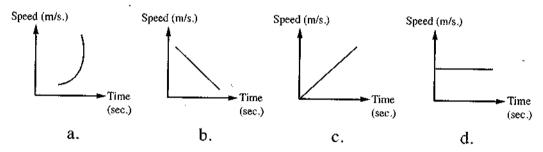
A Complete the following statements :

1. The product of the velocity of moving body × the time equal ....

2. The galaxy that solar system belongs to is called ....

3. The image formed by concave lens is always .... erect and diminished.

4. The nucleolus and nuclear membrane disappear at the end of .... of mitosis.

5. The change of an object position as time passes according to the position of another fixed object is called ....

B What is meant by each of the following ... ?

1. Fertilization.　　　　2. Pole of the mirror.　　　　3. Average speed.

C Within 2.5 second, the speed of a car increases from 20 m/s to 25 m/s, while a bike moves from rest and its speed reaches 10 m/s in the same time. Which moves at a greater acceleration ?

Question 2

A Choose the correct answer :

1. The reproduction which considered as a source of genetic variation is .... reproduction.

　a. vegetative　　　b. budding　　　c. sexual　　　d. regeneration

2. Which of the following is considered as scalar physical quantities ? ....

a. Force　　　　b. Mass.　　　　c. Acceleration.　　　　d. Velocity.

3. The scientist who established the nebular theory is ....

a. Chamberlain.　　b. Moulton.　　c. Fred Hoyle.　　d. Laplace.

4. Crossing over phenomenon happens in the end of first ....

a. prophase　　b. metaphase　　c. anaphase　　d. telophase

5. Which of the following graphs represents the movement of an object at a constant speed ? ....

a.　　　　　　b.　　　　　　c.　　　　　　d.

B **Give reasons for :**

1. Meiotic division is called by reduction division.

2. Pilots take in consideration the velocity of the wind.

3. The image formed by a plane mirror cannot be received on the screen.

C **An object is placed at a distance of 30 cm from a concave mirror with a radius of curvature 40 cm.**

1. Calculate the focal length of the mirror.

2. Show by drawing the path of rays that show the formed image in this case.

Question 3

A **Correct the underlined words :**

1. Velocity is the quantity that we can identify it accurately by knowing its **magnitude only**.

2. Spores are formed in bread mould fungus inside special organs called **buds**.

3. The two gases which are produced galaxies, stars and universe over millions of years are **oxygen and nitrogen**.

4. If an object is put in front of concave mirror at **focus,** the formed image is real, inverted and equal to the object.

5. When a moving object covers unequal distances at equal periods of time so, it moves with **non-uniform acceleration**.

B What would happen when ... ?

1. A light ray passes through the optical center of the lens.
2. Putting a yeast fungus in a warm sugary solution.
3. The initial speed of the moving body is greater than the final speed.

C Compare between each of the following :

1. Short-sightedness and long-sightedness (according to the position of the formed image).
2. Asexual reproduction and sexual reproduction (according to the number of parents).

Question 4

A Write the scientific term :

1. The distance covered in a certain direction.
2. The nucleic acid that carries the genetic traits of the living organisms.
3. The speed of the moving object relatively to a constant or moving observer.
4. An equipment was launched to the space, allows astronomers an opportunity to study the evolution of the universe.
5. The rebounding of the light to the same side when it strikes a reflecting surface.

B Mention the importance of each of the following :

1. Speedometres in the car.
2. Nano-molecules of gold.
3. A convex mirror which is put at the left side of the driver of the car.

C Two cells are divided, one of them in the plant stem and the other in the plant ovary, if you know the number of chromosomes in each of them is 6 pairs of chromosomes, mention :

1. The kind of cell division in each cell.
2. The number of chromosomes in each resulted cell.

8 El-Dakahlia Governorate

Answer the following questions :

Question 1

A Choose the correct answer :

1. The accurate definition of the speed is the distance covered through ....
   a. the time.   b. a unit time.   c. an hour.   d. a minute.
2. (Speed - time) graph for a regular motion at a constant speed is a straight line is ....
   a. curved.   b. passing by the origin point.
   c. parallel to x-axis.   d. parallel to y-axis.

3. When an object is placed to face a convex mirror, the image formed is ....

    a. lies behind the mirror. b. is real.   c. is erect.   d. (a) and (c).

4. Fred Hoyle relates controlling the Sun in the orbits of the planets around it to .... of the Sun.

    a. temperature   b. rotation speed   c. attraction force   d. glowing

5. The chemical structure of the chromosome is ....

    a. the nucleic acid only.   b. protein and nucleic acid.

    c. protein, fats and nucleic acid.   d. all the previous.

B Pierre Simon Laplace is affected by two observations during the assumption of the nebular theory, mention them.

C A runner covered a distance of 60 meters of a straight track in 10 seconds, and then he returned back walking. He took 50 seconds to come back to the starting point of running. Calculate the runner's average speed :

    1. While running.   2. While returning.   3. During the whole trip.

Question 2

A Complete the following sentences :

1. The contact lenses are used instead of the .... and it is made of ....

2. The convex lens .... the light, while the convex mirror .... the light.

3. The force is considered .... physical quantity, while the distance is considered .... physical quantity.

4. The solar system is located in one of the spiral arms of the .... on the ....

5. There are two types of reproduction in living organisms which are .... and ....

B Compare between : reproduction by budding and reproduction by sporogony according to site of occurrence and give examples for each.

C Two cars move in the same direction, if the speed of the first car is 50 km/h and the second car is 70 km/h. Calculate the relative speed of the second car relative to an observer :

    1. Standing on the ground.   2. Sitting in the first car.

    3. What are you conclude from the resultants.

Question 3

A Write the scientific term of each of the following :

1. The regular speed by which the moving object moves to cover the same distance at the same period of time.

2. The change of the object speed by equal values through equal period of time.

3. Bouncing of the light to the same side when it strikes a reflecting surface.

4. The ability of some animals to compensate their missing parts.

5. The point inside the lens on the principal axis in the mid distance between its faces.

B Show by drawing what happen in anaphase 1 for meiosis division.

C A car moves at speed 40 m/sec. If the driver used the brakes to decrease the speed so, it decreases by 2 m/sec². Calculate its speed after 15 seconds from using the brakes.

Question 4

A Correct the underlined words :

1. When an object is placed at **the center of curvature** of a concave mirror, its formed image is real, inverted and enlarged.

2. **Crossing star** is a glowing gaseous sphere revolving around itself, from which the solar system was originated.

3. **Concave mirror** is a transparent medium that refracts the light and is limited with two spherical surfaces.

4. **Average speed** is the speed of a moving object relative to a constant or a moving observer.

B Give reasons for :

1. The word ambulance is written in a laterally inverted way on the ambulance car.

2. The short-sightedness is corrected by using a concave lens.

3. The lens had two foci, while the spherical mirror has one focus.

4. Cellular division begins with interphase before starting mitosis division.

C Show scientific reason for each of the following :

1. The angle of reflection of a light ray fall perpendicular on a plane mirror = zero.

2. A body moves at zero acceleration.

9 — Ismailia Governorate

Answer the following questions :

Question 1

A Complete the following sentences :

1. The movement path in one direction may be ...., ... or a combination of both.

2. Force is considered .... physical quantity, while mass is .... physical quantity.

3. The cell .... contains the genetic material of the living organism which consists of a number of ....
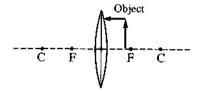
B **What are the results of each of the following :**

1. Less convexity of eye lens surfaces.

2. Rupturing of the sporangium of bread mould fungus.

C **In the opposite figure :**

1. Complete the path of the rays to form an image for the object.

2. Mention the properties of the formed image.

Question 2

A **Write the scientific term for each of the following statements :**

1. The value of a moving object's speed relatively to a constant or a moving observer.

2. The covered distance at a certain direction.

3. The straight line that passes by center of curvature of the mirror and its pole.

4. A glowing gaseous sphere formed the planets of the solar system.

5. The total distance covered by a moving object divided by the total time taken to cover this distance.

B **In the opposite figure :**

A person moves from point (A) to point (B), then changes his direction to point (C) through 10 seconds, Calculate :

1. The total distance covered by the person.

2. The displacement done by the person.

3. The velocity.

C **Compare between :**
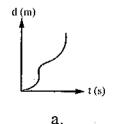
Crossing star theory and the modern theory according to assumption of each about the origin of the solar system.

Question 3
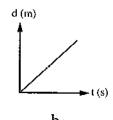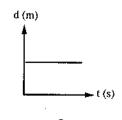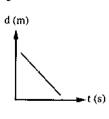
A **Choose the correct answer :**

1. The graph .... represents the movement of a body at a constant speed.

a.   b.   c.   d.

2. From the properties of the image formed by a convex mirror is ....

a. virtual.   b. real.   c. upright.   d. (a) and (c) together.

3. Chromosomes of reproductive cells are doubled in the interphase before .... division.

a. first meiosis   b. second meiosis   c. mitotic   d. no correct answer.

4. If a person stands at a distance 2 m from a plane mirror, the distance between the person and his image is ....

a. 1 m.   b. 2 m.   c. 3 m.   d. 4 m.

5. The value of change of an object speed in one second is called ....

a. velocity.   b. displacement.   c. acceleration.   d. speed.

B The opposite figure represents the crossing over phenomenon, Answer the following :

1. What happens in this phenomenon ?

2. What is the name of the phase in which this phenomenon occurs ?

3. Draw the following phase to the phase in which this phenomenon occurs.

C Mention only one use for each of the following :

1. The contact lenses.   2. The solar telescope.

Question 4

A Rewrite the following statements after correcting the underlined words :

1. Radius of mirror curvature = $\frac{1}{2}$ × the focal length.

2. The chromosome consists of two chromatids connected together at the **nucleus**.

3. The speed of a car can be identified directly by using the **compass**.

4. In the universe, groups of **planets** are gathered to form the galaxies.

B Give reasons for :

1. The lens had two centers of curvature (C_1 and C_2).

2. The moving body with acceleration cannot move with regular speed.

3. Binary fission is considered a mitotic division.

C Choose from column (B) what suits column (A) :

(A)	(B)
1. Reproductive cells	a. in which mitotic division occurs.
2. Plant cells	b. produce gametes.
3. Somatic cells	c. in which the spindle fibers is formed from the cytoplasm.
	d. contain a haploid number of chromosomes.
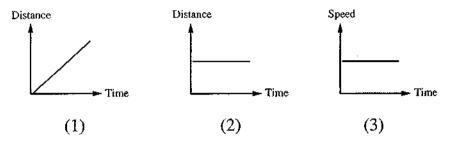
10 Suez Governorate

Answer the following questions :

Question 1

Ⓐ Complete the following sentences :

1. The movement path may be .... or .... or both of them.

2. When the object lies in front of .... lens, a virtual and diminished image is formed.

3. The yeast fungus reproduces by ...., while the starfish reproduces by ....

Ⓑ When does this happen ... ?

1. The acceleration of a moving object = zero.

2. The displacement of an object = the distance that the object moved.

3. The person suffers from short-sightedness.

Ⓒ There are two types of cell division. One of them includes the following Phases :

(Anaphase - Metaphase - Telophase - Prophase)

1. What is the type of division that include these phases.

2. Arrange the previous phases according to the sequence of their occurrence.

Question 2

Ⓐ Choose the correct answer :

1. The number of chromosomes in the gamete is .... the number of the chromosomes in the original cell.

   a. quarter.   b. half.   c. double.   d. equals.

2. Our solar system is located in one of the .... arms of the Milky way galaxy.

   a. spiral   b. straight   c. circular   d. oval

3. The reproduction which considered as a source of genetic variation is a .... reproduction.

   a. budding.   b. vegetative   c. sexual   d. asexual

4. The distance from the center of mirror curvature and its focus equals ....

   a. radius of curvature.   b. quarter of the diameter of curvature.

   c. dimeter of curvature.   d. half of the focal length.

5. From the scalar quantities ....

   a. the time.   b. the force.

   c. the acceleration.   d. the displacement.

B Describe the case of the body in each of the following graphs :

(1)   (2)   (3)
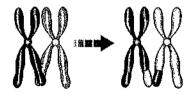
C What happens in the following cases :

1. Explosion of the expanded part from the Sun towards the crossing star (according to the crossing star theory).

2. The combination of the male gamete and female gamete.

Question 3

A Write the scientific term for the following :

1. Changing the position of an object as the time passes according to the position of another fixed object.

2. A point located inside the lens and lies on its principal axis.

3. The speed of the moving object relative to the observer.

4. It contains all the galaxies, stars, planets and living organisms.

5. It's a mirror that its reflecting surface is a part of a hallow sphere.

B 1. What is the name of this phenomenon in front of you ?

2. What is the importance of its occurrence.

3. Mention the name of the phase that this phenomenon occurs ?

C A driver used brakes to stop the car moved by 20 m/sec. Calculate the time taken by the car to stop. Given that the car moved with a decelerating motion equals 2 m/sec^2

Question 4

A Correct the underlined words :

1. When the light ray falls by an angle of **30°** on the reflecting surface, so the reflected ray will be perpendicular on the reflecting surface.

2. The parent individual disappears during the reproduction by **sporogony**.

3. The measuring unit of the speed is **meter/second^2**.

4. **Relative speed** represents the regular speed by which the moving object moves to cover the equal distance at the same period of time.

5. The universe emerged from the particles of **oxygen and nitrogen**.

B An object is put at a distance of 4 cm. from the optical centre of a lens a (real - magnified) image is formed for the object and when the object moved a distance of 2 cm away from the lens a (real-equal to the object) image is formed.

1. What is the kind of the lens ?

2. Draw the path of the rays that formed the image when the object was at a distance of 4 cm from the optical centre of the lens ?

C Give reasons for :

1. When you look at the mirror you see your face image.

2. There are no new species of grapes when they reproduce by vegetative reproduction.

11 Port Said Governorate

Answer the following questions :

Question 1

A Replace each of the following statements by a scientific term :
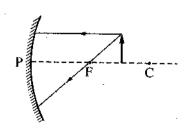
1. The change in the position of an object by the time relative to a reference point.

2. It contains the Sun and the solar system.

3. The mid-point on the reflecting surface of the mirror.

4. The part in the cell which is responsible for cellular division.

5. The incident light ray, the reflected light ray and the normal line all lie in the same plane perpendicular to the reflecting surface.

B Compare between :

1. Distance and displacement in terms of definition and type of the physical quantity.

2. Galaxy and solar system in terms of definition.

C Draw the figure in your answer paper, then :

1. Complete the path of the incident rays on the mirror from the object.

2. Mention the characteristics of the formed image and its position.

Question 2

A Correct the underlined words :

1. The spindle fibers in the animal cell is formed from **condensing the cytoplasm**.

2. The lens is a transparent medium that **reflects** the light.

3. In plane mirror the object distance from the mirror is **larger than** the image distance.

4. **Asexual** reproduction is a source of genetic variation.

5. The Sun takes about **250** million years to complete one rotation around the center of the galaxy.

B What is meant by ... ?

1. A car moving at a uniform speed = 80 km/hour.

2. The focal length of a concave mirror = 7 cm.

3. The average speed of a moving car = 70 km/hour.

C Within 2.5 seconds the speed of a car increases from 20 m/s to 25m/s, while a bike moves from rest and its speed reaches 5 m/s in one second. Calculate the acceleration of the car and the acceleration of the bike ?

Question 3

A Choose the correct answer :

1. Examples of scalar's physical quantities ....

    a. mass & force.
    b. force & acceleration.
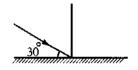
    c. mass & distance.
    d. force & time.

2. The two gases which produced galaxies, stars and universe through millions of years are ....

    a. oxygen & helium.
    b. helium & hydrogen.

    c. oxygen & carbon dioxide.
    d. helium & carbon dioxide.

3. .... reproduces by budding.

    a. Amoeba
    b. Starfish
    c. Sponge
    d. Mushroom

4. A light ray falls on to a plane mirror as in the figure it reflected, where the reflection angle equals ....

    a. 30
    b. 60
    c. 20
    d. 90

5. The universe contains ....

   a. galaxies & stars.

   b. planets and moons.

   c. living organisms.

   d. all the previous.

B Give reasons for :

1. On their flights, pilots take into consideration the velocity of the wind.

2. The universe is in continuous expansion.

3. Cataract disease infects the eye.

C The opposite figure represents one of the division phases :

1. What is the name of this phase and the type of division ?

2. What is the name of next phase that follow it.

Question 4
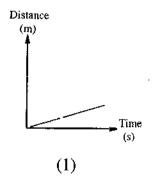
A Complete the following sentences :
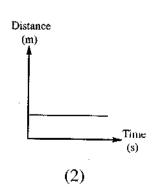
1. The .... scientist established the modern theory of evolution of the solar system.

2. Measuring the relative speed depends on the position of the .... who determines the magnitude of this speed.

3. The Egyptian scientist Mustafa El Said discovered a way to detect the cancer cell by using ....

4. A short-sighted person needs a medical eye glasses with .... lenses.

5. The chromosome chemically consists of nuclear acid called DNA and ....

B What happens when ... ?

1. A light ray passes through the optical center of a convex lens.

2. The nebula gradually lost its heat (from point of view of Laplace scientist).

3. A plane mirror is placed at the left side of the driver instead of the convex mirror.

C Describe the motion of the object in each of the following graph :

(1)

(2)

(12) Damietta Governorate

Answer the following questions :

Question 1

A Choose the right answer :

1. Spindle fibers appear during the cell division in the ....

   a. telophase.   b. interphase.   c. prophase.   d. metaphase.

2. The solar system is located in one of the .... arms of the "milky way" galaxy.

   a. spiral   b. oval   c. straight   d. circular

3. If speed of a car is 72 km/hour this means that his speed equal .... m/sec.

   a. 50   b. 10   c. 15   d. 20

4. When an object acceleration equal zero this means that ....

   a. the body acceleration is decreasing.   b. the body speed is variable.

   c. the body acceleration is increasing.   d. the body speed is uniform.

B Mention one the importance for each of the following :

1. Speedometer.   2. Interphase.

C Show by drawing and write the labels :

The properties of the formed image for an object located in front of a convex lens between the focus and center of curvature.

Question 2
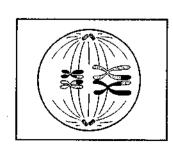
A Write the scientific term :

1. The combination of a male gamete and a female gamete to from a zygote.

2. The total distance covered by the moving object divided by the total time taken to cover the distance.

3. The space which contains all the galaxies, stars, planets and living organisms.

4. A type of asexual reproduction that occurs in simple algae.

B The opposite figure :

Represents one of the phases in a meiotic division

1. What is the name of this phase ?

2. Draw the diagram of the following phase ?

   ,What is the name of this phase.

C What happens when ... ?

1. The liver gets injured or apart of it is cut.

2. Elongation in the ball of the eye more than the normal situation.

Question 3

A Give reasons for :

1. Sexual reproduction is a source of genetic variation.

2. Pilots take in consideration the velocity of the wind.

3. There are no new races (new individual with other trait) of plants, when they reproduce by vegetative reproduction.

4. Displacement is vector physical quantity.

B What is meant by ... ?

1. The displacement of an object is 60 meters in west direction.

2. The distance between the focus of the concave mirror and its pole equal 10 cm.
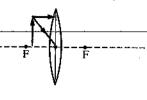
C Compare between :

1. Acceleration and deceleration (according to definition).

2. The crossing star theory and the modern theory (according solar system was originally).

Question 4

A On a straight line there is a moving bus whose speed changes from 6 meters/sec to 12 meters/second during a period of three second. What is value of acceleration ?

B Rewrite the following statements after correcting the underlined words :

1. If two cars moving in the same direction at the same speed equal 120 m/sec., so the relative speed equal **60 m/sec**.

2. **The scientist Isaac Newton** published a research entitled "world order" and that was in 1796.

3. **Mitotic cell division (mitosis)** amis to produce gametes.

4. Yeast fungus reproduce asexually by **regeneration**.

C Draw the figure in your answer paper then complete to obtain virtual, upright and enlarged image for the object.

13 Kafr El-Sheikh Governorate

Answer the following questions :

Question 1

A Complete the following sentences :

1. The solar system is located in one of the .... of the Milky Way on the edge of the galaxy and the Sun takes about .... year to complete one rotation around the center of the galaxy.

2. The spindle fibers in the animal cell is formed from ...., while in the plant cell the spindle is composed form the .... at the cell poles.

B What is the relation between the genetic structure for each of offspring and parents in the following cases :

1. Binary fission in paramecium.

2. The offspring resulting from the sexual reproduction.

C Explain what happens in the following cases :

1. The integration of the male gamete and female gamete.

2. Place the object in front of a concave lens.

3. The object placed in front of a convex mirror.

4. The nebula gradually lost its heat in the view of Laplace.

Question 2

A Write the scientific term of the following sentences :

1. A phase in which some important vital processes occur to prepare the cell for division and the amount of genetic material duplicates.

2. Is the straight line that passes by the pole of the mirror and it's center of curvature.

3. It is the ability of some animals to compensate their missing parts.

4. It is a theory that explains the origin of the universe from a massive explosion since 15000 million years.

B Show by drawing only of the image equal to the object by means of a convex lens.

C Complete the missing in the following table :

Speed (meter/s)	Distance (meter)	Time (second)
....	100	5
5	....	10
8	96	....

Question 3

A Identify the name of the division phase in which the following cases occur :

1. Chromosomes pairs arrange in the cell's equator.

2. Crossing over phenomenon.

B Compare between of the following :

1. Mitosis and meiosis division (purpose only).

2. Average speed and relative speed (concept only).

C Within 2.5 seconds the speed of the car increases from 20 m/sec to 25 m/sec, while a bike moves from the rest and its speed reaches 5 m/sec in one second, which of them moved at a greater acceleration.

Question 4

A Choose the correct answer :

1. The scientist who founds modern theory of the world is ....
   a. Fred Hoyle.   b. Laplace   c. Moulten.

2. The two factors in which the movement of an object can be described ....
   a. speed and time.   b. distance and time.   c. area and time.

3. Property of the image of the object formed by the plane mirror always be ....
   a. larger than the object.   b. equal to the object.
   c. smaller than the object.

4. A convex lens has a focal lenth of 50 cm. an object is places at a distance of 80 cm. from the lens, the image of the object is formed at a distance ....
   a. greater than 100 cm.   b. equal to 100 cm.   c. equal to 50 cm.

B Give reasons for the following :

1. The constancy of the planets in their orbits around the Sun.

2. The concave lens is used to treat a short-sightedness person.

C When the following occurs ... ?

1. The object moves at zero acceleration.

2. The incident light ray reflects back on itself when falling on a concave mirror.

14 El-Behira Governorate

Answer the following questions :

Question 1
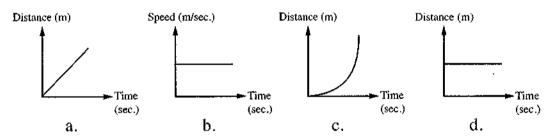
A Choose the correct answer :

1. A person stands in front of a plane mirror at a distance of 3 meter, so the distance between him and his image is .... meter.

   a. 3   b. 4   c. 5   d. 6

2. Which of the following graphs describes the movement of an object moves with acceleration ? ....

3. **In the opposite figure :**

   The value of angle of reflection for the incident light ray is ....

   a. 90°   b. 45°

   c. zero°   d. 30°

4. If the cell of muscles in a female rabbit contains 22 pairs of chromosomes, so the number of chromosomes in one cell of its ovary equal ....

   a. 11   b. 22   c. 44   d. 88

5. The scientists believe that the universe emerged from massive explosion and it is in ....

   a. continues contraction.   b. contraction then expansion.

   c. expansion then contraction.   d. continues expansion.

B A speed of a car increased from 10 m/sec to 20 m/sec during 5 seconds, at the same time a bike started movement from rest and its speed reached 10 m/sec. Which one of them moved at a greater acceleration ?

C Write the name of this phase, and mention :

1. When this phase happens ?

2. Why the cell passes through this phase ?

Question 2
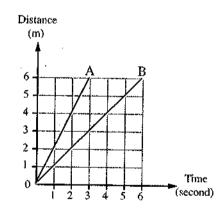
A Write the scientific term for each of the following :

1. The mass of cells which result from the abnormal cell when it is continually divided without controlling.

2. Biological process where the living organism produces new individuals of the same kind and thus, ensuring its continuity.

3. It is the speed of a moving object relative to a constant or a moving observer.

4. It is a very thin plastic lenses and can stick to the eye cornea.

5. It is the regular speed by which the object moves to cover the same distance at the same period of time.

6. A mirror whose reflecting surface is the outer surface of a sphere and diverges the light rays.

B For which type of celestial bodies, each of the following belongs :

1. The Earth.   2. The Milky Way.

C The opposite graph represents the (distance - time) graph for the movement of two objects A , B

From the graph, answer the following :

1. What is the kind of speed of the two objects ?

2. Calculate the ratio between the speed of object A and the speed of object B

Question 3
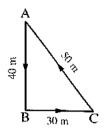
A Complete the following sentences :

1. Galaxies began to from after .... years after the Big Bang.

2. From the examples of the multicellular organisms reproduced by budding is ....

3. The point that lies in the middle of the reflecting surface of the concave mirror is called ....

4. The displacement covered by a body in one second is called ....

5. **In the opposite figure :**
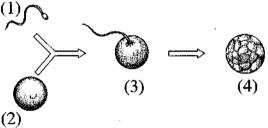
A body starts its motion from point (A)
to point (B), then to point (C), then returned
to point (A), so the displacement covered
equals .... metre.

(figure: right triangle with vertex A at top, B at bottom-left, C at bottom-right; AB = 40 m, BC = 30 m, hypotenuse AC = 50 m)

B **When the following cases happen ... ?**

1. The distance covered by an object equals the magnitude (amount of) displacement happened.

2. Formation of a real, inverted and equal image for an object that is placed in front of a concave mirror.

C **The opposite figure represents one of the important process to complete the reproduction.**

Answer the following :

(figure showing reproduction process: (1) (2) (3) (4))

1. What is the name of the process that number (3) refers to and what is the name of the produced cell ?

2. What is the importance of forming the cell number (3) ?

3. What is the kind of division in part (4) ?

4. What is the number of chromosomes in the cell number (1) ?

Question 4

A **Give reasons for :**

1. The short-sightedness is corrected using a concave lens.

2. Mass is a scalar quantity, while force is a vector quantity.

3. The word "AMBULANCE" is written laterally inverted way on the ambulance car.

4. No harmful effect happens for the donor person in liver transplantation.

B **What are the results of ... ?**

1. The gaseous cloud subjected to cooling and contraction processes "In Fred Hoyle theory".

2. The Euglena cell divided by three successive mitosis divisions.

3. The exchange of genes between two homologous chromosome's chromatids.

C An object is placed at a distance of 5 cm from a convex lens its focal length is 3 cm. Show by drawing the position of the formed image and mention the properties of this image, by drawing two light rays only.

15 El-Fayoum Governorate

Answer the following questions :

Question 1

A Complete the following sentences :

1. Speed measuring unit is ...., while the measuring unit of acceleration is ....
2. The crossing over phenomenon occurs in .... of .... division.
3. .... and .... are types of spherical mirrors.
4. The Sun and the planets revolving around it, rotate around the center of .... galaxy.
5. Force is a .... physical quantity, while mass is a .... physical quantity.

B What's meant by ... ?

1. Angle of incidence.   2. Regular (uniform) speed.   3. The pole of the mirror.

C "A car starts movement from rest until its speed reaches 25 m/s after 10 seconds."

1. Calculate the value of acceleration.   2. What kind is the acceleration ?

Question 2
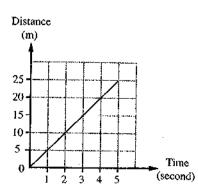
A Write the scientific term for each of the following statements :

1. The combination of the male gamete and the female gamete to form zygote
2. A disease that infects the eye lens and it becomes opaque.
3. A vector quantity that equals the displacement in one second.
4. Ability of animals to compensate their missing parts.
5. The distance that light travels in a year.

B What happens in the following cases :

1. If an object moves at a regular speed, what is the value of its acceleration ?
2. When there is elongation in the ball of the eye.

C An object moves according to the graphical relation shown in the opposite figure, calculate :

1. The speed of the object's motion and mention its kind.
2. The time that the object takes to cover a distance of 15 meters.
3. The distance that the object covers in 4 seconds.

Question 3

A Choose the correct answer :

1. A human being stood in front of a plane mirror at a distance of 2 meters, so the distance between him and his image is ....

   a. 1 meter.   b. 2 meters.   c. 3 meters.   d. 4 meters.

2. Meiotic division in flowering plants occurs in the anther to produce ....

   a. ovum.   b. chromosome.   c. pollen grains.   d. sperm.

3. Within minutes of the Big Bang, the percentage of hydrogen in the universe was ....

   a. 25%   b. 50%   c. 75%   d. 100%

4. If the speed of a car is 36 km/h , it means that its speed is .... m/sec.

   a. 10   b. 20   c. 40   d. 80
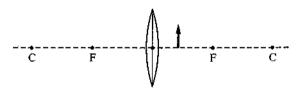
5. The spindle fibres appears during the cell division through the ....

   a. telophase.   b. interphase.   c. prophase.   d. metaphase.

B Give reasons for :

1. The moving car seems stable to the observer who moves at the same speed and direction.

2. The cell passes through interphase before starting meiotic division.

3. Pilots take in consideration the velocity and the direction of the wind.

C In the shows figure :

1. Complete the ray to get the image.
2. Mention the properties of the image.

Question 4

A Correct the underlined words :

1. The lens is a transparent medium that **reflects** the light and defined with two spherical surfaces.

2. If the object's speed decreases by time, it is called **acceleration**.

3. Amoeba reproduces by **Budding**.

4. **Mitotic** division leads to form gametes.

5. The scientist who found the modern theory about the evolution of the solar system is **Laplace**.

B Mention one usage for each of the following :

1. The speedometer.   2. Nano-molecules of gold.

C "Two cells divide, one in a human female stomach and the other in her ovary" Mention :
1. The type of the division in each of the two cells.
2. The number of the cells produced from the stomach cell division.

16 ⟨ Beni-Suef Governorate ⟩
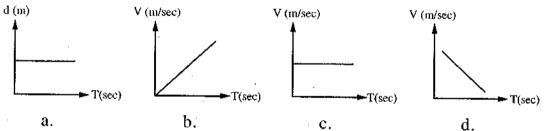
Answer the following questions :

Question 1

A Choose the correct answer :

1. The distance and displacement are equal when the body moves in a .... in one direction.
   a. zigzag   b. circular   c. straight line   d. curved

2. The following cells containing complete genetic material except ....
   a. germs.   b. bud.   c. zygote.   d. pollen grain.

3. If the distance between two centers of curvatures to the lens is 20 cm. so its focal length equal ....
   a. 5 cm.   b. 10 cm.   c. 15 cm.   d. 20 cm.

4. The ratio between final and initial speed for moving body with accelerating motion ....
   a. more than one.   b. less than one.   c. equal to one.   d. equal zero.

5. Which of the following graphs represents object moves with constant speed : ....

a.   b.   c.   d.
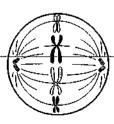
B Compare between each of the following :

1. Distance and displacement (as in type of physical quantity).
2. Crossing star theory and modern theory (as in origin of the solar system).
3. Somatic cell and reproductive cell (as in number of produced cells when cell division takes place in each of them).

C Through your study the stages of mitotic division answer the following :

1. Name the phase that preceding this phase the figure.
2. In which phase the centromere of each chromosome is split lengthwise into two halves ?
3. In which phase the spindle fibers disappear ?
4. What the importance of interphase ?

Question 2
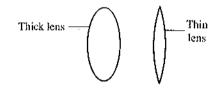
A Correct the underline words :

1. Meiotic division aims to **growth of living organisms**.

2. Light rays is **passing** when falling on reflected surface.

3. The old stars are gather in the **edges** of the galaxy.

4. The word ambulance is written on ambulance cars **minimized**.

5. Number of chromosomes in an ovum cell containing **double** number of chromosomes in the one of liver cells.

B Mention the following :

1. Theory that explain origin of universe.

2. What is meant by the average speed of moving car 70 Km/h

3. **In the opposite figure :**
   Which one of these lenses
   has largest focal length ?

Thick lens — Thin lens

C If an object moves from rest regularly until its speed reaches to 12 m/sec after 2 sec from the start of moving so :

1. The change of speed through 2 sec = ·········· m/sec.

2. Acceleration = ·········· m/sec^2.

Question 3

A Complete the following with suitable words :

1. From the multicellular organisms that reproduce by budding is ··········

2. ·········· reproduction doesn't required neither special systems nor structures in the living organisms.

3. ·········· are used instead of medical glasses to treat vision defects.

4. When the object is placed at ·········· of the convex lense, there is no image will be formed.

5. The moving car with 50 Km/h in constant direction its speed appears at 110 Km/h related to observer moves with 60 Km/h in ·········· direction of the car motion.
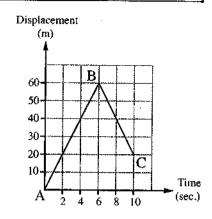
B What would happen in the following cases ... ?

1. Light ray that falls passing through center of curvature of the mirror.

2. A plane mirror is placed at the left side of the drivers instead of the convex mirror.

3. The parts of the inner chromatids are exchanged in the first prophase.

Part 3

C In the opposite figure, that represents the movement of an object from point (A) to point (C) passing by point (B), Calculate the following :
1. Speed.
2. Velocity.

Displacement (m) vs Time (sec.) graph with points A, B, C.

Question 4
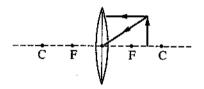
A Write the scientific term :
1. Chemically consists of DNA and protein.
2. Change of object position as time passes according to the location of another object.
3. A physical quantity that represents change in the object speed in unit time.
4. A method used by physicists to predict the mathematical relation between physical quantities.
5. It containing genetic materials from both parents and during growth it gives new individuals carries the traits of both parents.

B Give reasons for :
1. It's hard to measure the regular speed of a car practically.
2. The Sun escaped from the gravity of the huge star in the crossing star theory.
3. The number of chromosomes is constant in the same species which reproduce sexually.

C Transfer the following drawing to your answer sheet, then complete the direction of rays, then mention the properties of formed image.

C   F   F   C

17 El-Minia Governorate

Answer the following questions :

Question 1

A Choose the correct answer :
1. Amoeba reproduce by ....
   a. binary fission.   b. gametes.   c. regeneration.   d. buding.
2. Scientists believe that the matter of the universe was a .... ball of high pressure and high temperature.
   a. liquid   b. solid   c. gaseous   d. no correct answer

3. When an object is placed between the focus of a convex lens and its center of curvature, the formed image will be ....
   a. real, inverted and diminished.
   b. real, inverted and magnified.
   c. virtual, erect and magnified.
   d. virtual, erect and diminished.

B) Mention the name of the scientist who :

1. Put the nebular assumption theory about the evolution of the solar system.

2. Discovered a way to use Nano-molecules of gold to detect the cancer.

3. Used the way of concentrating the Sun rays to destroyed the Roman fleet in 212 B.C.

C) In a race, a runner moves at a regular speed of 10m/sec. from the start of the race to the fifth second and there was a car that moves beside him, the speed of the car increases from zero to 25 m/sec. in 5 seconds also.

(a) **Draw a graph (speed - time) and record on it.**

   (1) the movement of the runner.

   (2) the movement of the car.

(b) **Use the previous graph to calculate :**

   (1) the distance covered by the runner.

   (2) the time in which the speed of the runner is equal to the speed of the car.

Question 2
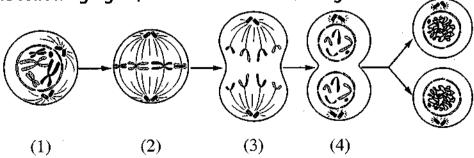
A) Write the scientific term of the following :

1. Fibers extend between the two poles of the cell in prophase.

2. The change in the position of a body by the time related to the position of another body.

3. The image that cannot be received on the screen.

4. A theory assumed that the solar system was originally a big star which is the Sun.

B) Mention the importance for the following :

1. A convex mirror is put at the left side of the driver of the car.

2. The direction of the wind affects the velocity of aircraft (plans).

C) Look at the following figure, then answer the following :

(1)   (2)   (3)   (4)

1. What is the kind of cell division in this figure ?

2. What is the name of phases number (2) and (3).

3. What will disappear in phase number (1).

Question 3

A Give reasons for :

1. In short-sightedness, the retina is far from the eye lens.

2. The importance of interphase in the cellular division.

3. The object which moves at regular speed, its acceleration equals zero.

4. The constancy of the planets in their orbits around the Sun.

B What happens when ... ?

1. If the liver gets injured or a part of it is cut.

2. A light ray passes through the optical center of the lens.

C Two trains move parallel to each other but in opposite direction the speed of the first train 65 km/h. and the speed of the second train is 85 km./h. Calculate the speed of the first train that observed by passengers in the second train.

Question 4

A Correct the underlined words :

1. **The force** is the length of the shortest straight line between two position.

2. It is a cell produced due to fertilization called **tetrad**.

3. **The lion** is considered one of the fastest wild animals.

4. The chromosome chemically consists of nuclear acid called DNA and **starch**.

B What is meant by ... ?

1. Crossing over phenomenon.   2. Vector physical quantities.

C Show by drawing the pass and the directions of rays to an object in front of a concave mirror at a distance greater than double focal length, knowing that its focal length is 0.025 m with determine the properties of the formed image.

18 Assiut Governorate

Answer the following questions :

Question 1
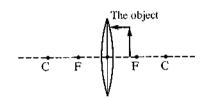
A Complete the following statements :

1. The crossing over phenomenon occurs in .... of first meiosis division.

2. The solar system consists of a number of .... planets revolve around the Sun.

3. The physical quantity that its magnitude and direction are necessary for identifying it is called ....

4. The combination of the male gamete and female gamete to form the zygote is known as ....

5. A concave mirror has a focal length of 20 cm , then the radius of curvature of its spherical surface equals ....

6. The space which contains all the galaxies, stars, planets, moons, living organisms and everything is called ....

Ⓑ From the opposite figure :

Complete the figure to get an image for the object.
and mention its properties of the formed image ?

Ⓒ What happens in the following cases ... ?

1. Increase the diameter of the eyeball from the normal state.

2. If the body cuts the same distance in half the time (to the speed of a body).

Question 2
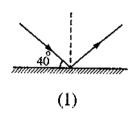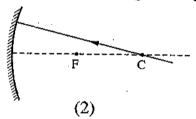
Ⓐ Correct the underlined words of the following :

1. The universe emerged from the particales of **oxygen** and hydrogen.

2. Form the properties of the image formed by the plane mirror is **real** , **inverted**, reversed and equal to the object.

3. The chromosome consists of two chromatids connected together **at the cytoplasm**.

4. **The irregular speed** is the value of displacement at a unit time and is a vector quantity.

5. Form speed measurement units are **meter / second^2** or kilometer/hour.

6. **The crossing star** is the largest star that can be seen from the surface of the Earth.

Ⓑ What is meant by each of the following ... ?

1. Light reflection phenomenon.

2. A car moving at a uniform speed = 80 kms/hour.

Ⓒ Mention one example for each of the following :

1. Scalar physical quantity.

2. An living organism reproduces by regeneration.

Question 3

A Write the scientific term for each of the following :

1. The value of an object's speed relative to the observer.

2. A flat gaseous round disk that formed the solar system planets according to the perception of "laplace" scientist.

3. A cell division that occurs in the somatic cells and results in the growth of the living organism.

4. The actual length of the path that a moving object takes from the starting point of movement to the end point.

5. It is located in one of the spiral arms of the Milky Way on the edge of the galaxy.

6. A biological process where the living organism produces new individuals of the same kind and thus ensuring its continuity.

B Calculate the value of the angle of reflection in the following two figures :

(1)   (2)

C Compare between each of the following :

1. The positive acceleration and the negative acceleration according to (the concept of definition).

2. Real image and virtual image according to (the ability of receiving on a screen).

Question 4

A Choose the correct answer :

1. The founder of modern theory of the solar system is .... scientist.

   a. Moulten   b. Chamberlain   c. Fred Hoyle

2. The image formed by using a concave lens is ....

   a. real, enlarged, and inverted.

   b. virtual, smaller and inverted.

   c. virtual, smaller and upright.

3. At the end of this phase, the nucleolus and nuclear membrane disappear from the mitosis division ....

   a. prophase.   b. metaphase.   c. telophase.

4. If a light ray falls passing through the optical centre of the convex lens, it leaves the lens ....

   a. passing through the focus.   b. parallel to the principal axis.

   c. without refraction.

5. The continuous expansion of the universe, is due to ....

   a. separation of galaxies.   b. approaching of galaxies.

   c. equivalent to galaxies.

B **Give reasons for each of the following :**

1. A convex mirror is put at the left side and right of the driver of the car.

2. Occurrence of interphase before starting the mitosis cell division.

C **A racer covered 50 meters northward within 30 seconds then 100 meters eastward within 60 seconds then 50 meters southward within 10 seconds, and then returns back to the start point within 40 seconds :**

1. Calculate the total distance that the racer moved ?

2. What is the average speed of the racer ?

3. Calculate the displacement ?

19 Sohag Governorate

Answer the following questions :

Question 1

A **Write a suitable word to complete the following statements :**

1. The force is a .... physical quantity and the time is a .... physical quantity.

2. The solar system is located in one of the .... arms of .... on the edge of the galaxy.

3. Correcting long-sightedness by using .... lens and correcting short-sightedness by using .... lens.

4. Yeast fungus reproduces asexually by ...., while the amoeba reproduces asexually by ....

B **A car moved from rest and its speed became 25 m/s in 10 seconds. Calculate its acceleration. With mention of its kind.**

C **What is meant by ... ?**

   1. The crossing over phenomenon.   2. The pole of the mirror.   3. Fertilization.

Question 2

A) Correct the underlined words :

1. If the speed of a car is 72 km/h. means its speed is = **40** m/s.

2. In the Big Bang theory explains that the universe is formed by the cohesion of **Oxygen and Nitrogen** particles.

3. Chromosomes pairs arranged on the cell's equator in **anaphase 1.**

4. The (distance - time) graph for regular motion at uniform speed is represented by **curve line** passing through the origin point.

B) Show by drawing the path of the light ray that forms the image of the object placed in front of a concave mirror at between the focus and the centre of curvature, What are the properties of the image being formed.

C) What happens in the following cases ... ?

1. The incident light ray passing through the optical center of the convex lens.

2. The nebula gradually lost its heat in the theory of Laplace scientist.

3. When the bread mold fungus falls on a suitable environment.

Question 3

A) Write the scientific term that correspond to each of the following :

1. Speed of the moving object relative to the observer which in resting or moving.

2. The solar system was a glowing gaseous sphere revolving around itself.

3. The line between the two centres of curvature of the lens passing by the optical centre of the lens.

4. Is the ability of animals to compensate their missing parts.

5. The phase which the cell prepares to division by the genetic material (DNA) duplicates.

B) Give reasons for each the following :

1. No image is formed when the object is placed at the focus of a convex lens.

2. Mitosis is important for children, unlike the meiosis.

3. The perpendicular incident light ray on plane mirror reflects on itself.

C) A racer covered 50 meters northward within 30 seconds, then 100 meters eastward within 60 seconds and then 50 meters southward within 10 seconds then stop. Calculate :

1. The average speed of the racer.

2. Velocity for racer.

Question 4

A Choose the correct answer :

1. The result of multiplying a speed of moving object by time ....

   a. acceleration.   b. mass.   c. distance.   d. force.

2. .... began to form after 3000 million years after the Big Bang.

   a. galaxies.   b. ancestral galaxies.   c. the Sun.   d. the Earth.

3. When the body covers equal distances in equal periods of time, the speed of the body is ....

   a. increases.   b. decreases.   c. irregular speed.   d. uniform speed.

4. If the length of the radius of curvature of concave mirror 20 cm, then the focal length of the mirror equals ....

   a. 5   b. 10   c. 15   d. 20

B Compare between :

1. Nebular assumption and the modern theory (in terms of origin of the solar system).

2. Real image and virtual image (in terms of the possibility be formed on a screen).

3. Long-sighted person and short-sighted person (in terms of the place of the image formed).

C If the number of chromosomes in a human pancreas cell is 23 pairs, then what is the number of chromosomes in the following cells.

1. Skin cell.   2. Sperm.   3. Fertilized egg.

20 Qena Governorate

Answer the following questions :

Question 1

A Complete the following sentences :

1. .... image can be received on a screen.

2. The stars move in a fixed orbit around the center of the ....

3. The measuring unit of acceleration is ....

4. Asexual reproduction takes place by .... in the yeast fungus.

5. We use .... lens to obtain a virtual and magnified image.

B What is meant by ... ?

1. The secondary axis of the mirror.

2. The crossing over phenomenon.   3. Nebula.

C Two cars move in straight line, the car (A) moves with speed 20 m/s, while the car (B) moves with speed 30 m/s. Calculate the distance covered by each car after one minute.

Question 2

A Choose the correct answer :

1. The Milky Way galaxy took its disc form after about .... million years after the Big Bang.

    a. 1000   b. 3000   c. 5000   d. 10000

2. From the examples of the vector physical quantities is ....

    a. time.   b. force.   c. mass.   d. length.

3. The optical piece which forms an image that inverted and equal to the object is ....

    a. concave lens.   b. concave mirror.   c. convex mirror.   d. plane mirror.

4. The nucleolus disappears during the mitosis cell division in ....

    a. prophase.   b. metaphase.   c. anaphase.   d. telophase.

5. (Distance - time) graph for an object moves at regular speed is represented by a straight line ....

    a. parallel to time axis.   b. parallel to distance axis.

    c. passing through the origin point.   d. (a) and (c) together.

B What is meant by each of the following ... ?

1. The radius of curvature of the face of a concave lens = 20 cm.

2. A car moves of regular speed 80 km/h.

C Compare between :

1. The crossing star theory and the modern theory (according the name of the scientist).

2. Short-sightedness and long-sightedness (according to reasons of each).

3. Somatic cells and gametes (according to number of chromosomes).

Question 3

A Put (✓) or (×) in front of the following sentences :

1. The universe emerged from the particles of hydrogen and helium.   ( )

2. The convex lens is thick at the center and less thick at the tips.   ( )

3. The simplest type of motion is the motion in a curved path. ( )

4. A person moves 40 metres northward then returned 20 metres southward,
   so his displacement is 60 metres northward . ( )

5. Each group of stars is gathered in the solar system. ( )

6. A car covers 500 meters in 25 minutes, so its speed equals 20 m/sec. ( )

B What happen in the following cases ... ?

1. An object is put at the focus of a convex lens.

2. The starfish misses one of its arms and it contains a part of its central disk.

C Mention one use (or importance) for each :

1. Mitosis division.

2. The convex mirror is placed in the left side of the car driver.

Question 4

A Write the scientific term for each of the following sentences :

1. The combination of a male gamete and female gamete to form a zygote.

2. The speed of moving object relative to the observer.

3. The space which contains all the galaxies, stars, planets and living organisms.

4. The displacement covered through a unit time .

5. The point of connection of two chromatids of the chromosome together.

B Give reasons for :

1. The word ambulance is written in a converted (laterally inverted) way on the
   ambulance car.

2. The continuos expansion of space.

3. The moving cars cannot move inside crowded town all the time by uniform
   (regular) speed.

C An object is put at a distance of 10 cm from a concave mirror, its focal is 4 cm :

1. Draw a diagram to show the path of the rays falling on the mirror and the path of the
   rays that are reflected from it.

2. Mention the properties of the formed image.

21 Luxor Governorate

Answer the following questions :

Question 1

Ⓐ Choose the correct answer :

1. The source of genetic variation is the .... reproduction.
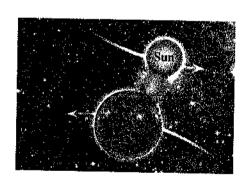
   a. budding
   b. vegetative.
   c. sexual.
   d. regeneration.

2. A body of length 4 cm is placed at a distance of 8 cm from a convex mirror, so the length of the formed image becomes ....

   a. 16 cm.
   b. 8 cm.
   c. 4 cm.
   d. less than 4 cm.

3. In case of motion that is described as movement at irregular speed, it is useful to refer to another term which is the .... speed.

   a. uniform.
   b. scalar.
   c. vector.
   d. average.

4. If a person was putting a pen in his left pocket, then the formed image of the pen on a plane mirror will be on the .... side as it is ....

   a. left – reversed
   b. right – upright
   c. right – reversed
   d. left – virtual

Ⓑ What is meant by ... ?

1. The distance covered by an object is changed by 2 m each second.

2. The combination of male gamete with female gamete to form a zygote.

3. The focal length of a concave lens is 7 cm.

Ⓒ In the opposite figure, mention :

1. The name of the theory.

2. The effect of the attraction force on the gaseous line that extends from the Sun ?

3. The number of the galaxies in the universe.

Question 2

Ⓐ Complete the following sentences :

1. The straight distance covered by the object in a certain direction is called ....

2. The .... telescope is from the space telescopes.

3. The spindle fibers are formed during the cell division in ....

4. The double of the distance between the optical center of a lens and its focus = ··········

B **Give reasons for :**
1. The continuous expansion of the universe.
2. The technic of discovering the cancer cells by using the Nano-molecules of gold depend on using special protein.
3. No image is formed when the object is put in the focus of a convex lens.

C **An object moves with a uniform acceleration in a fixed direction, its speed reaches 3.6 km/h after 5 second, then after another 11 seconds, its speed reaches 1.3 m/s calculate :**
1. The acceleration of the moving object.
2. The initial speed of this object (by km/h).

Question 3

A **Write the scientific term for each of the following :**
1. The straight line joining between the two centers of curvature of the lens.
2. A type of asexual reproduction that takes place in plants' vegetative organs without the need of seeds.
3. The result of multiplying half the speed of a body with double of the time.
4. A theory based on an astronomical phenomenon in which a star was glowing for a short time, and then its glowing disappears gradually.

B **What happens when ... ?**
1. The centrosome disappears from the animal cell.
2. An object is put at distance equal to the double of the focal length of a convex lens.
3. The nebula loses its heat in the assumption of Laplace.

C **A moving car (A) in straight line measures the relative speed of a car (B) which was in the opposite direction, it found that the relative speed of the car (B) was 140 km/h and when the car (A) reduces its speed to the half, it found that the relative speed of the car (B) becomes 100 km/h, calculate the real speed of the two cars ?**

Question 4
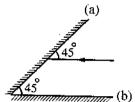
A **Correct the underlined words in the following :**
1. When the object covers equal distance at equal periods of time, this means that the object move with **a negative** acceleration.
2. the solar system is located in one of the **circular** arms of the Milky Way galaxy.
3. When putting a body on a distance of 16 cm from a concave mirror its focal length is 12 cm, then the image formed will be **virtual upright** and magnified image.
4. Pilots take in consideration the **uniform speed** of the wind.

B From the opposite figure answer :

Complete the drawing and calculate the angle of
incidence from the mirror (a) on the mirror (b)
and mention the reason ?

(a)

(b)

C 1. Compare between : The long-sightedness and short-sightedness in the term of the reasons and the treatment ?

2. If the number of chromosomes in a pancreatic cell was 23 pair, so what is the number of chromosomes in :

(a) A skin cell.

(b) A fertilized egg cell.

22 Aswan Governorate

Answer the following questions :

Question 1
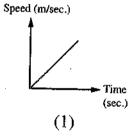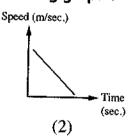
A Complete the following sentences :

1. .... is defined as the covered distance within a unit time.

2. The Sun and surrounding planets revolve around the centre of ....

3. Asexual reproduction in the bread mould happens by ....

4. The distance between the focus of the concave mirror and its pole is called ....

B What happens in the following ... ?

1. The parts of the inner chromatids are exchanged in the first prophase.

2. A light ray incident by an angle 45° on a plane mirror.

C Describe the motion of the body in each of the following graph :

Speed (m/sec.)

Time (sec.)

(1)

Speed (m/sec.)

Time (sec.)

(2)

Question 2

A Choose the correct answer :

1. The incident light ray passing through the focus of concave mirror ....

a. refracts parallel to the principal axis.

b. refracts passing through the center of curvature.

c. reflects parallel to the principal axis.

d. reflects passing through the center of curvature.

2. The parental individual disappears when the reproduction occurs in the ....

   a. bacteria.   b. yeast.   c. bread mould.   d. all the previous.

3. The concept of the body movement means ....

   a. constancy of its position with the change in the time.

   b. the change in its position with the time.

   c. its speed.   d. its acceleration.

4. The scientist who establish the modern theory of the solar system is ....

   a. Chamberlain.   b. Moulten.   c. Fred Hoyle.   d. Laplace.

B Give reasons for :

1. The distance is a scalar physical quantity while the displacement is a vector quantity.

2. Cellular division begins with interphase.

C What is meant by ... ?

1. Uniform speed.

2. The pole of the spherical mirror.

Question 3

A Write the scientific term :

1. The straight line joining the two centers of curvature of the lens.

2. The ability of some animals to compensate the missing parts by reproduction.

3. The speed of the moving object relative to the observer.

4. The gaseous round disk that formed the planets of the solar system.

B Compare between each of the following :

1. Long-sightedness and short-sightedness. (according to the position of the formed image)

2. Sexual reproduction and asexual reproduction. (according to the genetic traits of the resulted offspring)

C Draw a path of light rays that illustrate the formed image of object is placed at a distance more than double of the focal length in case of the convex lens, then mention the properties of the formed image.

Question 4

A Correct the underlined words :
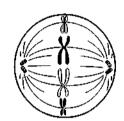
1. The solar system contains many **stars**.

2. **Euglena** reproduces asexually by budding.

3. **The focus** is a point inside the lens, the principal axis passes by it.

4. Velocity $= \dfrac{\text{distance}}{\text{total time}}$

B A racer covered 50 meters northward within 30 seconds then 100 meters eastward within 60 seconds then 50 meters southward within 20 seconds and then returns back to the start point within 40 seconds :

1. Calculate the total distance that the racer moved ?

2. What is the average speed of the racer ?

3. What is the displacement ?

C The opposite diagram represents a phase in mitotic division :

1. What is the name of this phase ?

2. What is the changes happens in this phase ?

23 The New Valley Governorate

Answer the following questions :

Question 1

A Choose the correct answer :

1. When the object covers equal distances at unequal periods of time, it moves with a .... speed.

   a. uniform   b. negative   c. positive   d. non-uniform

2. The car (A) moves at 80 km/h and the car (B) moves at 40 km/h in the same direction. Therefore the speed of the car (A) relative to the observer in the car (B) equals .... km/h.

   a. 40   b. 80   c. 30   d. 120

3. The number of chromosomes in a gamete is .... the number of chromosomes in the original cell.

   a. equal to   b. a half of   c. a quarter of   d. a double of

4. Our solar system is located in one of the .... arms of the Milky Way galaxy.

   a. spiral   b. oval   c. straight   d. circular

B What happens when ... ?

1. Sporangia of bread mould fungus rupture.

2. The diameter of the eyeball elongates.

3. Initial speed of a moving object is more than the final speed (according to the acceleration of its movement).

© An object is placed at the distance of 15 centimeters from the spherical mirror with a diameter of 40 cm. Then an image which could be received on a screen is formed.

1. What is the type of the mirror ?

2. Determine the position and properties of the image formed by the mirror.

Question 2

Ⓐ Complete the following sentences with the correct answer :

1. Laplace's theory assumed that nebula lost its heat, so its size .... and its revolving speed around .... increased.

2. The focal length of the convex lens equals the distance between .... and ....

3. The atomic particles merged together producing .... gas and .... gas which over millions of years produced galaxies, stars and the universe.

4. Distance is one of the .... physical quantities but force is one of the .... physical quantities.

Ⓑ Mention the name of the scientist who used the way of the collection of the Sun rays against the Roman fleet and mention the name of the optical piece used.

© A car moves from rest and its speed reaches 25 m/sec in 10 seconds. Calculate the acceleration with which the car moved.

Question 3

Ⓐ Write the scientific term for each of the following :

1. The group of galaxies which revolve together in the universe space due to gravity.

2. The length of the shortest straight line between the primary position of movement and the final position of movement.

3. A disease which infects the eye and causes vision defects because the eye lens becomes opaque.

4. The process of genes exchanging between the two inner chromatids of the tetrad.

Ⓑ If you know that there are two types of cell division and one of them contains the following phases :

(Anaphase – Metaphase – Telophase – Prophase)

1. Arrange these phases according to the priority of occurrence.

2. What is the type of the division which contains these phases ?

C Give reasons for each of the following :
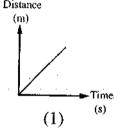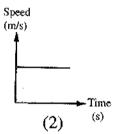
1. A convex mirror is placed on the right and on the left of a car driver.

2. It is impossible to obtain a real image by using a concave lens.

3. The genetic material duplicates in the interphase before entering into the mitosis division.

Question 4

A Rewrite the following sentences after correcting the underlined mistakes :

1. **Gene** is a site in which the two homologous chromatids in the chromosome connect.

2. If the angle between the incident ray and the reflected ray from a plane mirror is 140°, the angle of incidence is **40°**.

3. **Pollination** is the combination of the female gamete and the male gamete to form a zygote.

4. If the uniform speed of a car is 72 kilometers/hour, this means that its speed is **18 meters/second**.

B Describe the movement of an object which is represented by the following graphs :

(1) (2)

C Mention the assumptions of the crossing star theory which clarify the evolution of the solar system.

24 South Sinai Governorate

Answer the following questions :

Question 1
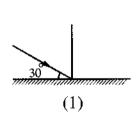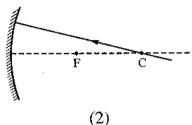
A Choose the correct answer :

1. Measuring unit of speed is ....

a. meter.sec.   b. meter/sec.   c. meter/sec.^{2} d. meter.

2. The short-sighted person needs a medical eye glasses with .... lenses.

a. convex   b. concave   c. plane   d. convex and concave

3. Number of chromosomes in female gamete equal .... the number of chromosomes in the original cell.

a. quarter   b. half   c. same   d. double

4. When the object covers equal distances at unequal of periods of time, the speed is called ....

 a. uniform.   b. negative.   c. positive.   d. non-uniform.

5. The filamentous fibers called a spindle fibers is composed in ....

 a. telophase.   b. interphase.   c. prophase.   d. metaphase.

B A car starts moving from rest, the speed of the car increase to 25 m/sec after 10 second. Calculate the acceleration of this car.

C Calculate the angle of reflection in each of the following figures :
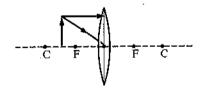
(1)   (2)

Question 2

A Write the scientific term :

1. The value of an object's speed relative to the observer.

2. Located in one of the spiral arms of the Milky Way galaxy.

3. Ability of animals to compensate their missing parts.

4. A cell division that occurs in the somatic cells and results in the growth of the living organism.

5. A phase in which some important vital processes occur to prepare the cell for division and the genetic material in the cell is doubled.

B Complete the following drawing :

Then mention the properties of formed image.

C Mention one example for the following :

1. Vector physical quantity.

2. Living organism reproduce by spores.

Question 3

A Complete the following sentences :

1. The radius of curvature of the convex mirror equals .... of its focal length.

2. The crossing over phenomenon occurs in the .... of .... division.

3. The physical quantities that has magnitude only to identify is ....

4. The modern theory of the world belongs to .... scientist.

B Give reasons for the following :

1. It is hard to measure regular speed practically.

2. The parent disappear during binary fission.

C Mention one use for contact lenses.

Question 4

A Put (✓) or (×) in front of the following sentences :

1. Each lens has one center of curvature.

2. Meiosis division aims to the production of the gametes. ( )

3. Displacement is the value of change of an object's speed in one second. ( )

4. There are a concave mirror at the left of the car driver. ( )

5. The expansion of the universe and the merging of atomic particles creating oxygen and nitrogen. ( )

B Complete the spaces in the table :

Speed (m/s)	Distance (m)	Time (sec)
.... (1)	100	5
5	.... (2)	10
8	96	.... (3) ....

C What happens when ... ?

1. The nebula gradually lost its heat according to Laplace.

2. The male gamete combines with female gamete.

25 North Sinia Governorate

Answer the following questions :

Question 1

A Complete the following statements :

1. If a car covers a distance = 72 km within a time = 1 hour, the car's speed during this time is .... m/s.

2. Distance is considered as .... physical quantity and force is considered as ....
physical quantity.

3. The vision defect which is due to a shortness in the radius of the ball is called ....

4. The solar system is located in one of the spiral arms of .... on the edge of the galaxy.

5. The chromosome chemically consists of nuclear acid called .... and ....

6. When the male gamete fuses with the female gamete, ... is formed.

B **Show by drawing only the formation of a virtual, upright and magnified image by using the spherical mirror.**

Question 2

A **Write the scientific term for each of the following :**

1. The speed of a moving body relative to the observer.

2. The total distance that a moving object covers divided by the total time taken to cover this distance.

3. A point inside the lens lies on the principal axis in the mid distance between its faces.

4. It contains all the galaxies, stars, planets and living organisms.

5. A phase in which some important vital processes occure to prepare the cell for division and the genetic material in the cell is doubled.

B **Mention the properties of the formed image by the concave lens.**

C **Compare between somatic cells and reproductive cells in accordance to :**

1. Number. of chromosomes.   2. No. of produced cell.   3. Type of division.
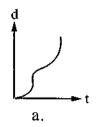
Question 3
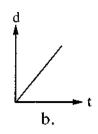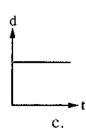
A **Choose the correct answer :**

1. The concept of the body movement means : ....

   a. Constancy of its position with the change in the time.   b. Its speed.

   c. The change in its position with the time.   d. Its acceleration.

2. Which of the following graphs represents the movement of an object at constant speed ....

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3. The shortest distance covered by a body in certain direction is called ....

a. the distance.　　b. the displacement.　　c. the acceleration.　　d. the speed.

4. A light ray that falls on a plane mirror as in the figure it reflected where the reflection angle equals ....

a. 30°　　　　　　b. 60°

c. 90°　　　　　　d. 180°

5. The source of genetic variation is the .... reproduction.

a. budding　　　　b. vegetative　　　　c. sexual　　　　　d. asexual

6. If a person stands at 3 m from a plane mirror, so the distance between the person and his image is ....

a. 3 m.　　　　　b. 6 m.　　　　　c. 9 m.　　　　　d. 12 m.

B What is meant by each of the following ... ?

1. A moving car covers a distance of 100 kilometers in two hours.

2. The regeneration.

Question 4

A Give reasons for :

1. The mitosis division is important for children.

2. The velocity is a vector physical quantity.

B Show by drawing only the formation of the image equal to the object by means of a convex lens.

C A car moves with speed 80 m/s . If the driver used the brakes to decrease the speed, so it decreased by 2 m/s². Calculate its speed after 12 seconds from using the brakes ?

D What happens when ... ?

The nebula loses its temperature in Laplace's opinion.

26 Red Sea Governorate

Answer the following questions :

Question 1

A Complete the following statements :

1. Path of motion in one direction may be .... or .... or the two motion together.

2. The chromosome consists from .... connected at ....

3. The focal length for the convex lens equal to the distance between .... and ....

4. The force is consider .... physical quantity and the mass is .... physical quantity.

5. The fertilization process is the combination between .... and .... to form a zygote when it grows, it gives a new offspring.

B What happens when ... ?

1. A light ray pass in the optical centre of lens.

2. A cloud of gas remained and subject to cooling and contraction processes as modern theory.

3. Putting the yeast fungi in a warm sugar solution.

C What mean with each of the following ... ?

1. The nebula.

2. The distance which an object travels in the east direction equal 30 metre.

Question 2

A Write the scientific term for each of the following :

1. The point that is in the middle of the reflecting surface of the spherical mirror.

2. A network of filamentous fibers, extend between the two poles of the cell in the prophase.

3. A vision defects leads to formation of image behind the eye retina.

4. The result of multiplying a speed of a moving object by time.

5. It contains all galaxies, stars, planets and living organism.

B Write the function of :

1. Speedometers is in airplanes and cars.

2. DNA nuclear acid.

C An object moving in straight line, the table show the distances and times what is the object move.

Distance (m)	10	20	30	40	50
Time (sec.)	5	10	15	20	25

1. Draw the graph (distance - time).

2. Calculate the speed of moving object.

Question 3
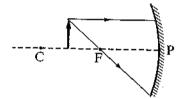
A Give reason for each of the following :

1. Asexual reproduction produce new individuals identical to the parents.

2. The incident light ray perpendicular on reflecting surface reflect on itself.

3. A moving car with speed seems constant to the observer in anther moving car in the same direction, and with the same speed.

4. The mitosis division very important for the children.

B Correct the underlined words :

1. The <u>crossing star</u> is a big star can seen from the Earth.

2. The <u>real</u> image cannot receive on the screen.

3. The meiotic division in the <u>somatic</u> cells.

4. The number of chromosome in plant stem equal <u>quarter</u> its number in the pollen grains for the same plant.

C Transfer the drawing to your answer sheet, then answer :

1. Complete the light rays to form the image of the object.

2. The properties of the formed image.

Question 4

A Choose the correct answer :
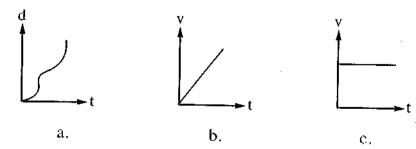
1. The .... found in one spiral arm of Milky Way galaxy.

   a. galaxy   b. universe   c. solar system

2. The reproduction by spores accur in this living organisms except ....

   a. amoeba.   b. bread mould.   c. mushroom.

3. A convex lens with focal length 5 cm, put a body at a distance more than the double of its focal length, the image formed is real, inverted and small at a distance .... cm.
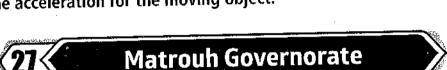
   a. 5   b. 8   c. 10

4. The graph .... is the object move with acceleration equal zero.

    a.   b.   c.

5. The light ray reflect in the same medium when meeting the reflecting surface this is ....

   a. reflection phenomenon.   b. refraction phenomenon.   c. (a) and (b) together.

B This shape is a vital phenomenon.

1. Write its name.

2. The name of the phase where this phenomenon accrue.

3. What is the important of this phenomenon.

C The object start to move from rest and its speed become 15 m/s through 3 second. Calculate the acceleration for the moving object.

27 Matrouh Governorate

Answer the following questions :

Question 1

A Choose the correct answer :

1. Bread mould fungus reproduces by ....

   a. budding.   b. spore propagation. c. binary fission.   d. regeneration.

2. A car covers 180 meters in two seconds, so its speed = ...

   a. 90 m/sec.   b. 180 km/h.   c. 25 km/h.   d. 45 km/h.

3. The image of the body formed by plane mirror is always ....

   a. virtual – enlarged – erect.   b. real – diminished – inverted.

   c. real – equal – inverted.   d. virtual – equal – erect.

4. According to the Big Bang theory, within minutes from the origin of the universe, the ratio of hydrogen to helium is ....

   a. 75 : 1   b. 25 : 1   c. 3 : 1   d. 1 : 3

B Compare between :

1. Long-sightedness and short-sightedness. (The type of lens used in treatment)

2. Metaphase of mitosis and metaphase of meiosis (I). (With drawing).

C A car moves at a speed of 60 m/sec. If the driver used the brakes to decrease the speed by 3 m/s², calculate the time after which the car stops.

Question 2

A Write the scientific term :

1. The ability of some animals to compensate their missing parts.

2. The point inside the lens on the principle axis in the mid distance between its faces.

3. The rate of change of displacement.

4. The value of an object speed relative to the observer.

5. The point of collection of the refracted light rays which is produced when the light rays fall parallel to the principal axis of a lens.

B A concave mirror with a focal length of 6 cm. and an object is placed at a distance of 8 cm from the mirror, Determine the position of the formed image and its characteristic by drawing and direction of rays.

C What is meant by ... ?

1. Crossing over phenomenon.   2. Nebula.

Question 3

A Put (✓) or (×), Then correct the wrong one :

1. The spindle fibers are formed in the plant cell from the centrosome.   (   )

2. A spherical mirror whose diameter is 12 cm its focus lies at a distance 6 cm from the pole.   (   )

3. Somatic cells are divided by meiosis which lead to the growth of living organisms and compensation of damaged cells.   (   )

4. According to modern theory the star exploded due to huge nuclear reactions.   (   )

5. When an object moves at an acceleration equals zero this means that the object moves at a uniform speed.   (   )

B Give reasons for :

1. Sexual reproduction is source of genetic variation.

2. The continuous expansion of universe.

3. Some persons have short-sightedness.

C When do following values equal zero :

1. An angle of incidence of light ray on a plane mirror.

2. The displacement of a moving object.

Question 4

A Complete the following statements :

1. According to modern theory the gaseous cloud subjected to .... and .... processes forming the matter of planets.

2. Asexual reproduction takes place by .... in yeast fungus and by .... in bacteria.

3. If a car moves at a speed of 70 km/h and it seems to an observer at a speed 120 km/h therefore the speed of the moving observer is .... km/h and in the .... direction.

4. The incident light ray passing through the centre of curvature of the mirror reflects with an angle = ...

5. Starfish reproduces asexually by ....

B **What happens when ... ?**

1. When the distance between a planet and the Sun increases.

2. The length of the eye radius is longer than normal.

3. The nebula loses its temperature according to Laplace's theory.

C **Mention the importance of each of the following :**

1. Gravity in solar system.

2. Light year.

3. The gaseous line in the crossing star theory.

1 Cairo Governorate

Answer the following questions :

Question 1

Ⓐ Complete the following sentences :

1. The Sun and the surrounding planets revolve around the centre of .... galaxy.

2. Mitosis occurs in the .... cells of living organisms.

3. Distance is a .... physical quantity, while force is a .... physical quantity.

4. The scientist who established the modern theory about the evolution of the solar system is ....

Ⓑ What is meant by each of the following ... ?

1. Angle of reflection.   2. Uniform acceleration.   3. The pole of a mirror.

Ⓒ An object moves in a straight line northward at a speed of 5 m/sec. and its speed reaches 20 m/sec through 3 seconds.

Calculate the following :

1. The velocity after 3 seconds.   2. The acceleration of the moving object.

Question 2

Ⓐ Choose the correct answer :

1. The crossing over phenomenon takes place at the end of ....

   a. prophase I.   b. metaphase I.   c. anaphase I.   d. telophase I.

2. A body of length 4 cm is placed at a distance of 8 cm from a convex mirror, so the length of the formed image becomes ....

   a. 16 cm.   b. 8 cm.   c. 4 cm.   d. less than 4 cm.

3. The ability of some animals to compensate their missing parts is called the ....

   a. budding.   b. regeneration.   c. sporogony.   d. sexual reproduction.

4. The line between the centres of curvature of the lens passing by the optical centre of the lens is called the ....

   a. focal length.   b. principal axis.   c. secondary axis.   d. radius of curvature.

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5. The scientists believe that the universe emerged from a massive explosion and it is in ....

    a. continues contraction.
                  b. contraction then expansion.

    c. expansion then contraction.
              d. continues expansion.

B Explain by drawing :

The properties of the image formed by a convex lens when an object is placed between the focus and double of the focal length.

C Give reasons for :

1. Displacement is a vector quantity.

2. The focal length of a concave mirror can be determined by knowing its radius of curvature.

Question 3

A Rewrite the following statements after correcting the underlined words :

1. When a moving car covers equal distances at equal periods of time, so it moves with a **relative** speed.

2. The solar system includes **nine** planets revolve around the Sun.

3. The chromosome consists of two chromatids connected at the **cytoplasm**.

4. Nebular theory suggested that the solar system originated from a glowing gaseous sphere revolving around **the Sun**.

5. The two gases which produced the galaxies, stars and universe over millions of years are helium and **nitrogen**.

B What would happen in the following cases ... ?

1. Absence of centrosome in the animal cell.

2. A light ray is incident passing through the optical centre of a convex lens.

C Two race cars, the first car moves at a speed of 80 km/h, while the second car moves at a speed of 120 km/h, in the same direction. Mention the following :

1. The relative speed of the first car relative to an observer standing on one side of the race road.

2. The relative speed of the second car relative to passenger in the first car.

Question 4

A Write the scientific term for the following :

1. The distance moved through a unit time.

2. The combination of the male gamete and female gamete to form a zygote.

3. The space which contains all the galaxies, stars, planets and living organisms.

4. The regular speed by which the object moves to cover equal distances at the same period of time.

5. An optical piece is thin at its centre and more thick at the tips and diverging light rays falling on it.

6. Asexual reproduction takes place in some plants without needing seeds but through their vegetative organs.

B Compare between the following :

1. Short-sightedness and long-sightedness (concerning : the correction of both).

2. Positive acceleration and negative acceleration (concerning : the definition).

2 Giza Governorate

Answer the following questions :

Question 1

A Complete the following sentences :

1. The distance that a moving object covers within a unit time is known as ....

2. The incident light ray which is parallel to the principal axis of a concave mirror reflects passing through ....

3. The founder of the modern theory is the scientist ....

4. The scientists believe that the matter of the universe was a .... ball of high pressure and high temperature.

B What is meant by ... ?

1. Displacement of an object equals 50 metre eastward.

2. The distance between the principal focus of a spherical mirror and its pole = 20 cm.

C Compare between : Lenses and mirrors (concerning : the definition).

Question 2

A Choose the right answer :

1. If the speed of a car is 72 km/hour, this means that its speed equals .... m/s.
   a. 18   b. 20   c. 40

2. If an object is placed at a distance less than the focal length of a concave mirror, a virtual upright .... image is formed.
   a. diminished   b. equal   c. magnified

3. The ability of some living organisms (animals) to compensate their missing parts is known as ....

a. budding.   b. regeneration.   c. sporogony.

4. The spindle filaments appear during cell division in ....

a. telophase.   b. interphase.   c. prophase.

B Define each of the following :

1. The scalar physical quantity.

2. The crossing over phenomenon.

C A car moved from rest and its speed became 25 m/s. during 10 seconds. Calculate its acceleration.

Question 3
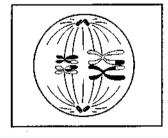
A Write the scientific term for each of the following :

1. The distance that a moving object covers divided by the total time taken to cover this distance.

2. The angle between the reflected light ray and the normal line at the point of incidence on the reflecting surface.

3. A group of stars that rotate together in cosmic space by the effect of gravity.

4. The point of connection of the two chromatids of the chromosome during the cell division.

B Give reasons for :

1. The continuous expansion of space.

2. The image formed by the convex mirror can't be received on a screen.

C The opposite figure represents one of meiotic division (meiosis) phases :

1. What is the name of this phase ?

2. Draw the phase next to this phase.
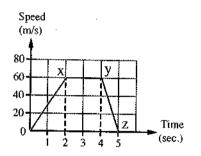
Question 4

A Correct the underlined parts in the following :

1. The relative speed of a moving car to an observer at rest is **less than** the real speed.

2. If the angle between the reflected light ray and the reflecting surface is 40°, the angle of incidence equals **40°**.

3. The theory that explains the origin of the universe is **nebular theory**.

4. Reproduction by spore propagation occurs in **paramecium**.

B What are the results of ... ?

1. Less convexity of the eye lens surfaces.

2. Approaching of a huge star to the Sun according to the crossing star theory.

C From the opposite graph which represents the motion of a car :

1. The value of the maximum speed of the car equals .... m/s.

2. The kind of acceleration in part (yz) is ....
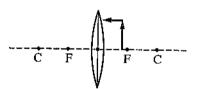
3 Alexandria Governorate

Answer the following questions :

Question 1

A Complete the following sentences :

1. The atomic particles fused and formed .... gas and .... gas, which formed the galaxies, stars, and universe.

2. The long-sighted person needs glasses of .... lens.

3. Vegetative reproduction in plants happens by .... division.

4. Vector velocity $= \dfrac{..........}{\text{Total time}}$.

B Copy the opposite figure to your answer sheet, then complete the rays to get an image for the body and mention its properties.

C For a moving body when can we describe it as follow ... ?

1. Moves by the simplest type of movement.

2. Moves by irregular speed.

Question 2

A Write the scientific term :

1. Fusion of the male gamete and the female gamete to form the zygote.

2. The speed of an object relative to an observer.

3. The force that controls the orbits of the planets around the Sun according to the modern theory.
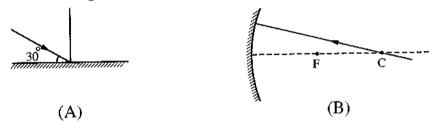
B Give reasons for :

1. The formed image by the convex mirror is always virtual.

2. Occurrence of interphase before starting the cell division.

C Mention only the tools that are used in the determination of the radius of curvature of a concave mirror, then illustrate the relation between the radius of curvature and the focal length.

Question 3

A Rewrite the following statements after correcting the underlined parts :

1. Meiosis happens in the **somatic cells**.

2. The formed image by the plane mirror is **real and inverted**.

3. Nebular theory suggested that the origin of the solar system was a flaming **solid mass** rotates around itself.

B In the following two figures :

What is the value of the angle of reflection of the incident rays in figures (A) and (B)?

(A)   (B)

C What is the importance of crossing over phenomenon in the sexual reproduction ?

Question 4

A Choose the right answer :

1. The image of the object that lies at the centre of curvature of a concave mirror is ....
   a. real, inverted and enlarged.   b. real, upright and equal to the object.
   c. real, inverted and equal to the object.   d. virtual, upright and equal to the object.

2. If the chromosomal number in the male gamete of an organism is 20 so, the chromosomal number in the liver cell equals ....
   a. 5 chromosomes.   b. 10 chromosomes.   c. 20 chromosomes.   d. 40 chromosomes.

3. .... established the crossing star theory.
   a. Laplace   b. Fred Hoyle   c. Hubble   d. Chamberlain

4. The centromere of each chromosome divides longitudinally and the spindle fibers contract in mitosis during ....
   a. prophase.   b. metaphase.   c. anaphase.   d. telophase.

B Mention one example for each of the following :

1. Scalar physical quantity.

2. An organism reproduces by spores.

C A bike started movement from rest and its speed reached 5 m/sec. in 2.5 second, at the same time the speed of a car changed from 20 m/sec. to 45 m/sec., calculate the acceleration of each of them, then mention the type of acceleration in each of them.
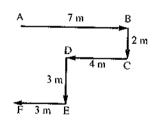
4 El-Kalyoubia Governorate

Answer the following questions :

Question 1

A Write the scientific term of the following sentences :

1. Specialized cells which produce gametes.

2. Changing the position of an object as the time passes according to a fixed point.

3. A point inside the lens that lies on the principal axis at mid distance between the faces of the lens.

4. Something that includes all galaxies, stars, planets and living organisms.

5. The speed of a moving body relative to a moving or a static observer.

B A body moves in the path (ABCDEF) as in the opposite figure. Calculate :

1. The distance that the body moved.

2. The displacement of the body.

C Give reasons for :

1. The force is a vector quantity.

2. When the object is placed at the focus of a convex lens, the image is not formed.

3. There are no new races of grapes, when they reproduce by vegetative reproduction.

Question 2
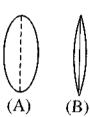
A Choose the correct answer :

1. The number of chromosomes in the gamete is .... the number of chromosomes in the original cell.

a. equal to   b. half   c. quarter   d. double

2. When the body covers equal distances at unequal periods of time, the speed will be ....

    a. regular.   b. decelerated.   c. accelerated.   d. irregular.

3. If the distance between the two centres of curvature of the lens is 20 cm. , this means that the focal length is ....

    a. 5 cm.   b. 10 cm.   c. 15 cm.   d. 20 cm.

4. All the following cells contain full copy of genetic material except ....

    a. spore.   b. bud.   c. zygote.   d. pollen grain.

5. The point at the middle of the reflecting surface of a spherical mirror is called ....

    a. focus of mirror.   b. pole of mirror.

    c. centre of curvature of mirror.   d. face of curvature of mirror.

B A student takes a time of 15 minutes to reach his school when he moves at an average speed (2 m/s). Calculate the total distance covered by the student when goes to school and returns back again to his starting point.

C The opposite figure shows a vital phenomenon :

1. What is the name of this phenomenon ?

2. Mention the name of the phase in which this phenomenon occurs and mention the type of its division.

3. What is the importance of its occurrence ?

Question 3

A Put (✓) or (×) in front of the following sentences :

1. Attraction force of the Sun that controls the orbit of the planets around it is one of Laplace's assumptions.   (   )

2. When the light ray falls by an angle of zero on the reflecting surface, so the reflected light ray will be perpendicular on the reflecting surface.   (   )

3. When the body moves at a constant speed, so the acceleration will be regular.   (   )

4. In the Big Bang theory, the universe is formed from gathering of oxygen and hydrogen particles.   (   )

5. Asexual reproduction keeps the genetic structure of living organisms.   (   )

B Write the assumptions of crossing star theory for the origin of the solar system (4 assumptions only).

C Determine the position of an object in front of a concave mirror if the formed image is :

1. Real, inverted and magnified.

2. Virtual, erect and magnified.

3. Real, inverted and minimized.

Question 4

A What happens ... ?

1. When an injured liver or cutting a part of it.

2. To the displacement of a moving body when it returns back to its starting point.

3. To the speed of a body if it covers the same distance in half the time.

4. When rupturing sporangium in bread mould fungus.

5. To the distance between the image and the plane mirror when the body becomes closer to the mirror.

B In the opposite figure, two eye lenses for two eyes equal in eye diameter for two different persons. Which of them has short-sightedness and why ?

C Compare between :

1. Principal axis of spherical mirror and lens (according to : the definition).

2. Positive acceleration and negative acceleration (according to : initial speed and final speed).

3. Crossing star theory and modern theory (according to : the founder).

(A)   (B)

5 El-Sharkia Governorate

Answer the following questions :

Question 1

A Complete the following sentences :

1. .... scientist who founder the nebular theory.

2. The spindle fibers are formed during the cell division in ....

3. .... are formed of groups of stars in the universe.

4. If a beam of parallel rays fall on the concave lens, and they parallel to the principal axis, so the rays pass through the concave lens .... as if they come from a point .... the lens.

B Define each of the following :

1. The optical centre of the lens.   2. The binary fission.   3. Contact lens.

C Represent the relation (speed - time) graphically :

If the car starts to move from rest (speed = zero) and after 1 second, its speed becomes 2 m/s, after another second, its speed increases to 5 m/s, then the driver had to use the brakes to slow down the car speed to 1 m/s, in the third second, and he stops completely after another second.

Question 2

A Choose the correct answer :

1. The uniform acceleration means that the object speed .... by equal values through equal periods of time.

   a. increases only

   b. decreases only

   c. increases or decreases

   d. doesn't change

2. From the scalar physical quantities is the ....

   a. acceleration.   b. time.   c. velocity.   d. displacement.

3. The object moves at a constant (uniform) speed when ....

   a. it moves at a constant acceleration.   b. it covers equal distances at unequal times.

   c. it covers equal distances at equal times. d. no correct answer.

4. A concave mirror with a focal length of 20 cm, and the object is placed at a distance of 50 cm from the mirror, the image is formed at a distance ....

   a. more than 40 cm.

   b. more than 20 cm and less than 40 cm.

   c. equals 20 cm.

   d. equals 60 cm.

5. The centromere of each chromosome is divided longitudinally, then the two chromatids are separated from each other in the ....

   a. prophase.   b. metaphase.   c. anaphase.   d. telophase.

B Give reasons for :

1. The object that is placed at the focus of a convex lens has not an image.

2. The nebula lost its sphere form and became in a form of a flat rotating disk.

3. Sexual reproduction is a source of genetic variation.

C Compare with drawing only between :

The image which is formed when the object is placed at a distance less than the focal length of both of : Concave mirror and Convex lens.

Question 3

A Rewrite the following statements after correcting the underlined words :

1. The **incident light ray** is the light ray that bounces from the reflecting surface.

2. The Sun takes about **100 million years** to complete one rotation around the centre of the galaxy.

3. If the speedometer points to 72, this is equivalent to **15 m/s.**

4. In **convex** mirror, the image is inverted and equal to the object.

5. Many scientists believe that the universe emerged from a massive explosion **500 thousand years** ago.

B What happens if ... ?

1. Reproductive cells are divided by meiosis.
2. The initial speed of a moving body is greater than the final speed.
3. The combination of the male gamete and female gamete.

C If an object started its movement from point (A) and covered a distance 30 metres northward within 30 seconds, then 60 metres eastward within 20 seconds, and then 30 metres southward within 10 seconds. Calculate :

1. The total distance.
2. Average velocity, then mention its direction.

Question 4

A Write the scientific term for each of the following :

1. The speed of a moving object relative to a constant or a moving observer.
2. The rebounding of the light to the same side when it strikes a reflecting surface.
3. It is located in one of the spiral arms of the Milky Way galaxy on the edge of the galaxy.
4. A medical case as a result of the formation of the image behind the retina.
5. The space which contains all the galaxies, stars, planets, moons, living organisms and everything.

B 1. What is meant by : The focal length of a concave mirror = 10 cm.
2. Mention the second law of light reflection.
3. What are the results based on : The merge of the atomic particles together within minutes of the Big Bang.

C Compare with drawing only between :

Metaphase in first meiotic division and second meiotic division.

SCIENCE

2021

GUIDE ANSWERS

FIRST TERM

EL-MOASSER

SERIES

3**rd** prep.

CONTENTS

Guide Answers
of the Main Book

Unit one

Lesson **1**

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1. b	2. b	3. c	4. a	5. b	6. c
7. b	8. b	9. c	10. a	11. a	12. d
13. a	14. c	15. c	16. d	17. a	18. d
19. b	20. a	21. b	22. d	23. c	24. c
25. a	26. a				

2

1. a straight
2. faster
3. slower
4. metre/second
5. speedometer
6. uniform
7. The speed
8. increases to doule
9. 20 m
10. 1.8
11. 20 m/sec.
12. 80
13. 90
14. 25 m/sec.
15. 72 km/h.
16. regular speed
17. average.
18. Relative
19. different from
20. Average speed
21. an observer position
22. zero.
23. the difference between
24. rest
25. equal to

3

1. Motion.
2. Speed.
3. Distance.
4. Metre/second or Kilometre/hour.
5. Speedometer.
6. An object moves at a uniform speed.
7. Uniform speed
8. Light.
9. Irregular speed.
10. Average speed.
11. Relative speed.

4

1. motion – rest
2. motion.
3. distance – time.
4. straight – one
5. straight – curved
6. (A) – (B).
7. Speed
8. Distance.
9. metre/second – kilometre/hour.
10. 20
11. 3
12. 50
13. distances – an irregular
14. average speed.
15. regular – distance
16. 30 km/h.
17. 10 km/h.
18. 210 km/h.
19. observer
20. relative
21. 60 – opposite
22. 30 km/h.

5

(a) 20   (b) 50   (c) 12

6

1. Because the train (or metro) moves forward or backward in a straight path or curved path or combination of both.
2. To help us in identifying the speed of cars and planes directly.
3. Because speed = $\frac{distance}{time}$, so speed is inversely proportional to the time.
4. Because speed = $\frac{distance}{time}$, so speed is directly proportional to the distance.
5. Because the speed of car (A) = $\frac{50}{5}$ = 10 m/sec. , while that of car (B) = $\frac{64}{8}$ = 8 m/sec.
6. Because the speed of the car changes according to the conditions of the road and the traffics.
7. Because it covers equal distances at unequal periods of time or it covers unequal distances at equal periods of time.
8. Because the relative speed of a moving object when the observer is :
   – at rest, the relative speed is equal to its real speed.
   – moving, the relative speed is more than or less than its real speed, according to the direction of its movement related to the movement of the object.
9. Because the speed which the moving observer determined, it may be more than or less than the real speed of the moving object, according to the direction of its movement related to the direction of the movement of the moving object.
10. Because the relative speed equals the difference between their speeds equals zero.
11. Because that the observer moving with the same speed of the car and in its same direction.

7

1. It is the change of an object position (location) as time passes according to the position of another fixed object.
2. It is the distance moved through a unit time.
3. It is the speed by which the object covers equal distances at equal periods of time.
4. It is the speed by which the object covers equal distances at unequal periods of time or it covers unequal distances at equal periods of time.
5. It is the total distance covered by the moving object divided by the total time taken to cover this distance.

4

6. It is the speed of a moving object relative to a constant or a moving observer.

8

1. When it moves in a straight line in one direction.
2. When the object covers this distance through a unit time.
3. When the object covers equal distances at equal periods of time.
4. When the object covers equal distances at unequal periods of time (or unequal distances at equal periods of time).
5. (a) When the observer is at rest.
   (b) When the observer moves in the opposite direction of the object movement.
   (c) When the observer moves in the same direction of the object movement.
   (d) When the observer moves in the opposite direction and with the same speed of the moving object.
6. When the observer moves in the same direction and with the same speed of the moving object.

9

1. This means that the object is in a state of motion.
2. This means that the object moves at a regular speed equals 20 m/sec.
3. $V = \frac{d}{t} = \frac{100}{2} = 50 \text{ km/h}$

   This means that the speed of the car is 50 km/h.
4. This means that the car moves at a regular (uniform) speed.
5. This means that the object moves at a regular speed equals 2 m/sec.
6. This means that the object moves at a regular speed equals 5 m/sec.
7. This means that the object covers a distance 100 km each one hour.
8. This means that the body covers a distance 5 m each one second.
9. This means that the body position doesn't change as time passes (the body is at rest).
10. This means that the car covers a distance 80 km each one hour.
11. This means that the car moves at an irregular speed.
12. This means that the total distance covered by the moving car through one hour equals 70 km.
13. This means that the total distance covered by the moving car through one hour equals 60 km.
14. This means that the observer moves with the same speed of the car and in the same direction.

15. This means that the speed of a train relative to an observer equals 90 km/h.
16. This means that the real speed of the car equals $70 - 20 = 50$ km/h.

10

1.

Regular speed	Irregular speed
It is the speed by which the object moves when it covers equal distances at equal periods of time.	It is the speed by which the object moves when it covers equal distances at unequal periods of time (or unequal distances at equal periods of time).

2.

Points of comparison	Regular speed	Average speed
Definition :	It is the speed by which the object moves when it covers equal distances at equal periods of time.	It is the total distance covered by the moving object divided by the total time taken to cover this distance.
The law used :	$(V) = \frac{\Delta d}{\Delta t}$	$(\overline{V}) = \frac{\text{total (d)}}{\text{total (t)}}$
Its measuring unit :	m/sec. or km/h.	m/sec. or km/h.

3.

Average speed	Irregular speed
It is the total distance covered by the moving object divided by the total time taken to cover this distance.	It is the speed by which the object moves when it covers equal distances at unequal periods of time (or unequal distances at equal periods of time).

4.

Average speed	Relative speed
It is the total distance covered by the moving object divided by the total time taken to cover this distance.	It is the speed of a moving object relative to a constant or a moving observer.

5. The train moves slower than the car , where :
   $V_{train} = 72 \times \frac{5}{18} = 20$ m/sec.
   $V_{car} = 30$ m/sec.

11

(1) The distance that is covered by the moving body.

(2) The time taken by the moving body to cover this distance.

12

It helps us in identifying the speed of car directly.

13

1. Speed of the train $= 90 \times \frac{5}{18} = 25$ m/sec.

2. Speed of the car $= \frac{40}{2} = 20$ m/sec.

∴ The train moves at a higher speed, because the train covers a longer distance (25 m) than the car (20 m) at the same time (1 sec.).

14

1. Speed (V) $= \frac{d}{t} = \frac{450}{45} = 10$ m/sec.

2. Speed (V) $= \frac{d}{t} = \frac{250}{2} = 125$ km/h.

3. Speed (V) $= \frac{50}{2} = 25$ m/sec.

$= 25 \div \frac{5}{18} = 90$ km/h.

4. ∵ $V = \frac{d}{t}$ ∴ $t = \frac{d}{V} = \frac{500}{100} = 5$ hours.

The time of arriving $= 7 + 5 = 12$

∴ The time of the arrival of the train is 12 pm.

5. Time $= \frac{\text{Distance}}{\text{Speed}}$

$t_1 = \frac{120}{90} = 1.3$ hour

$t_2 = \frac{105}{70} = 1.5$ hour

Total time $= 1.3 + 1.5 = 2.8$ hours.

6. $V = 80 \times \frac{5}{18} = 22.2$ m/sec.

7. $\overline{V}$ (m/sec.) $= 120 \times \frac{5}{18} = 33.3$ m/sec.

$d = \overline{V} \times t$

d (in metres) $= 33.3 \times 10 = 333$ m.

d (in kilometres) $= \frac{333}{1000} = 0.333$ km.

8. (a) $V = \frac{d}{t}$, $d = 6t$

∴ $V = \frac{6t}{t} = 6$ m/sec.

(b) $t = \frac{d}{V} = \frac{360}{6} = 60$ sec.

9. The body moves at an irregular speed.

Because it covers unequal distances at equal preiods of time.

10. • Average speed of Ahmed = 1.5 m/sec.

• Average speed of Ali =

$\frac{\text{The distance that he covers (the first 15 sec. + the second 15 sec.)}}{\text{Total time}}$

$= \frac{(2 \times 15) + (1 \times 15)}{15 + 15} = 1.5$ m/sec.

• Average speed of Ahmed = Average speed of Ali = 1.5 m/sec.

11. Total distance (d) $= 300 \times 10 = 3000$ m.

Total time (t) $= 3 \times 60 = 180$ sec.

$\overline{V} = \frac{d}{t} = \frac{3000}{180} = 16.67$ m/sec.

12. $\overline{V} = \frac{\text{Total distance}}{\text{Total time}} = \frac{20 + 40}{4 + 11} = \frac{60}{15} = 4$ m/sec.

13. ∵ Relative speed = Real speed + Observer speed

$140 = V_B + V_A$

∴ $V_B = 140 - V_A$

∵ $100 = V_B + \frac{1}{2} V_A$

∴ $100 = (140 - V_A) + \frac{1}{2} V_A$

∴ $V_A = 80$ km/h.

∴ $V_B = 140 - 80 = 60$ km/h.

14. (a) $V = \frac{d}{t} = \frac{10}{5} = \frac{20}{10} = \frac{30}{15} = \frac{40}{20} = 2$ m/sec.

(b) It's a regular speed.

15. (a) $V = \frac{d}{t} = \frac{4}{2} = \frac{8}{4} = \frac{12}{6} = 2$ m/sec.

(b) [X] $= V \times t = 2 \times 8 = 16$ m.

[Y] $= \frac{d}{V} = \frac{20}{2} = 10$ sec.

16. $d_1 = 20$ km. $= 20000$ m.

$t_1 = 4$ min $= 240$ sec.

$d_2 = 40$ km $= 40000$ m.

$t_2 = 12$ min $= 720$ sec.

$\overline{V} = \frac{20000 + 40000}{240 + 720} = 62.5$ m/sec.

17. $V = \frac{d}{t}$

$d = V \times t$

$= 5 \times [15 \times 60]$

$= 5 \times 900$

$= 4500$ m. $= 4.5$ km.

18. (a) $\overline{V}$ (during the first minute) $= \frac{d}{t} = \frac{300}{60} = 5$ m/sec.

(b) $\overline{V}$ (during the second minute)

$= \frac{d}{t} = \frac{420}{60} = 7$ m/sec.

(c) $\overline{V}$ (during the two minutes together)

$= \dfrac{d}{t} = \dfrac{300 + 420}{60 + 60} = 6$ m/sec.

19. (a) $d = V \times t$
- Car (A) : $d = 20 \times 60 = 1200$ m.
- Car (B) : $d = 25 \times 60 = 1500$ m.

(b) $t = \dfrac{d}{V}$
- Car (A) : $t = \dfrac{100}{20} = 5$ sec.
- Car (B) : $t = \dfrac{100}{25} = 4$ sec.

20. $\overline{V} = 2$ m/sec.

$t = 15 \times 60 = 900$ sec.

$d = V \times t = 2 \times 900 = 1800$ m.

Total distance $= 1800 + 1800 = 3600$ m.

21. $V = \dfrac{d}{t}$

$d = V \times t = 25 \times 2 = 50$ km.

$d_{\text{(Total distance)}} = 15 + \acute{d}$ (distance after 1 h)

$50 = 15 + \acute{d}$

$\therefore \acute{d} = 50 - 15 = 35$ km.

$V_{\text{(of the racer after first hour)}} = \dfrac{d}{t} = \dfrac{35}{1} = 35$ km/h.

22. (a) No, because the car covers unequal distances at equal periods of time.

(b) 1. Speed during the first second

$= \dfrac{d}{t} = \dfrac{20}{1} = 20$ m/sec.

2. Speed during the third second

$= \dfrac{d}{t} = \dfrac{30}{1} = 30$ m/sec.

(c) $\overline{V} = \dfrac{\text{Total (d)}}{\text{Total (t)}} = \dfrac{20 + 25 + 30}{3} = \dfrac{75}{3} = 25$ m/sec.

23. $V = \dfrac{d}{t}$

$V_1 = \dfrac{d_1}{t_1} = \dfrac{80}{2} = 40$ m/sec.

$V_2 = \dfrac{d_2}{t_2} = \dfrac{120}{3} = 40$ m/sec.

$\therefore$ The body moves with a regular speed, because it covers equal distances at equal periods of time.

24. (a) $\overline{V}$ (while running) $= \dfrac{100}{10} = 10$ m/sec.

(b) $\overline{V}$ (while returning) $= \dfrac{100}{80} = 1.25$ m/sec.

(c) $\overline{V}$ (during the whole trip) $= \dfrac{100 + 100}{90} = 2.22$ m/sec.

25. Total time $= \dfrac{d}{V} = \dfrac{90}{36} = 2.5$ h.

The remaining time $= 2.5 - 2 = 0.5$ h.

The remaining distance $= 90 - 30 = 60$ km.

The average speed that the remaining distance covers $= \dfrac{60}{0.5} = 120$ km/h.

26. $t_{\text{(of the first thousand metres)}} = \dfrac{d}{V} = \dfrac{1000}{20} = 50$ sec.

The remaining time $= 100 - 50 = 50$ sec.

The remaining distance $= 3000 - 1000 = 2000$ m.

The average speed that the remaining distance covers $= \dfrac{d_2}{t_2} = \dfrac{2000}{50} = 40$ m/sec.

27. $t_1 = \dfrac{d_1}{V_1} = \dfrac{30}{3} = 10$ sec.

$t_2 = \dfrac{d_2}{V_2} = \dfrac{120}{6} = 20$ sec.

$\overline{V} = \dfrac{d_1 + d_2}{t_1 + t_2} = \dfrac{30 + 120}{10 + 20} = 5$ m/sec.

28. $\because$ Relative speed = Actual speed – Observer's speed

$\therefore$ Actual speed = Relative speed + Observer's speed

Actual speed = 130 + 50 = 180 km/h.

29. $\because$ Relative speed = Actual speed + Observer's speed

$\therefore$ Actual speed = Relative speed – Observer's speed

Actual speed = 80 – 30 = 50 km/h.

30. (a) 70 km/h
   (b) 70 – 50 = 20 km/h
   (c) The relative speed of the car depends on the position and direction of the observer.

31. Relative speed = 90 + 60 = 150 km/h.

32. (a) 80 km/h.
   (b) 120 – 80 = 40 km/h.

Answers of Timss

1 $\overline{V} = \dfrac{d}{t} = \dfrac{36}{12} = 3$ m/sec.

$\overline{V}$ (km/h) $= 3 \div \dfrac{5}{18} = 10.8$ km/h.

2 * The time of arrival of the first player to the ball

$t_1 = \dfrac{d_1}{V_1} = \dfrac{50}{3} = 16.67$ sec.

* The time of arrival of the second player to the ball

$t_2 = \dfrac{d_2}{V_2} = \dfrac{35}{2} = 17.5$ sec.

$\because$ The time of arrival of the first player to the ball is less than the time of arrival of the second player to the ball.

$\therefore$ The first player was catch the ball first.

3 (a) $V = \dfrac{d}{t} = \dfrac{160}{2.5} = 64$ km/h.

(b) The remaining distance = $160 - 40 = 120$ km.

The remaining time = $2.5 - 1 = 1.5$ h.

$V = \dfrac{120}{1.5} = 80$ km/h.

4 Total time = $\dfrac{d}{V} = \dfrac{45}{18} = 2.5$ h.

The remaining time = $2.5 - 1 = 1.5$ h.

The remaining distance = $45 - 15 = 30$ km.

The average speed that covers the rest of the distance = $\dfrac{30}{1.5} = 20$ km/h.

5 The actual speed of the steamship = $550 - 425$
$= 125$ km/h.

$t = \dfrac{d}{V} = \dfrac{60}{125} = 0.48$ h = 28.8 min.

6 $t = \dfrac{d}{V} = \dfrac{180}{15} = 12$ min.

∵ Samy arrives to school at seven o'clock and twenty-seven minutes at morning.

∴ He will attend the school queue.

7 Actual speed = Relative speed – Observer's speed
(Radar) = $120 - 50 = 70$ km/h.

∵ The actual speed (70 km/h) less than the maximum speed on this road (90 km/h).

∵ This car not infraction.

Lesson 2

1

1. c	2. b	3. b	4. a	5. a	6. d
7. c	8. a	9. d	10. c	11. d	12. d
13. a	14. b	15. c	16. a	17. b	18. c
19. b	20. a	21. b	22. c	23. a	24. a
25. c	26. c	27. d	28. d		

2

1. mathematical relations (graphs and tables)
2. passing through the origin point.   3. directly
4. parallel to the time axis.
5. constant speed   6. m/sec^2.
7. positive acceleration.   8. zero
9. Acceleration   10. positive
11. $\dfrac{\text{Final speed – Initial speed}}{\text{Time } (\Delta t)}$ 12. greater
13. 0.5 m/sec^2.   14. a uniform
15. irregular.   16. final

3

1. Tables and graphs.   2. Acceleration.

3. m/sec^2 or km/h^2.   4. Uniform acceleration.
5. Negative acceleration.   6. Positive acceleration.
7. negative acceleration.

4

1. graphs – tables   2. straight – origin
3. directly – time.   4. straight – time
5. a regular
6. metre/second – metre/second^2.
7. accelerating – decelerating
8. zero.   9. acceleration.
10. Change in the speed (ΔV)   11. final – initial
12. greater   13. increases
14. equal – equal periods of time. 15. speed - time
16. 20 m/sec.   17. (a) 12   (b) 6
18. 4

5

1. In order to :
   – predict the relation between certain physical quantities.
   – understand practical results.
   – describe physical phenomena in an easier way.
2. Because the distance is directly proportional to the time when the object moves at a constant speed.
3. Because this body covers equal distances at equal periods of time (direct relation).
4. Because the object speed remains constant as time passes.
5. Because the car speed decreases as time passes.
6. Because its speed changes by passing time.
7. Because when moving with a positive acceleration, the final speed is greater than the initial speed, so the acceleration is positive, while when moving with a negative acceleration, the final speed is less than the initial speed, so the acceleration is negative.
8. Because there is no change in object speed as time passes ($\Delta V =$ Zero).

6

1. This means that the body moves at a regular speed. Or, the body moves at zero acceleration.
2. This means that the regular speed of the body equals 30 m/sec. or 30 km/h.
3. This means that the object moves with acceleration equals 100 m/sec^2.
4. This means that the body moves in a straight line and its speed changes by 3 m/sec. each one second.
5. This means that the body moves in a straight line and its speed decreases by 2 m/sec. each one second.
6. This means that the body moves at a negative acceleration, where its speed decreases by 3 m/sec. each one second.

7. This means that the car moves at a negative acceleration equals − 1 m/sec²

$$a = \frac{V_2 - V_1}{\Delta t} = \frac{15 - 20}{5} = -1 \text{ m/sec}^2$$

8. This means that the body moves at a uniform speed.
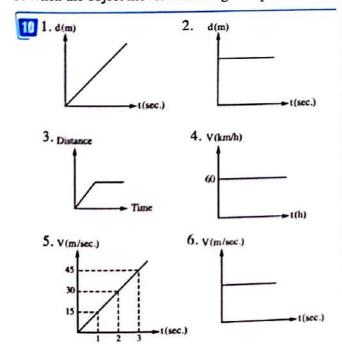
7

1. It is the change of an object speed in one second in a specific direction.
2. It is the acceleration by which an object moves in a straight line when its speed changes by equal values through equal periods of time.
3. It is an acceleration by which an object moves in a straight line when its speed increases by equal values through equal periods of time.
4. It is an acceleration by which an object moves in a straight line when its speed decreases by equal values through equal periods of time.

8
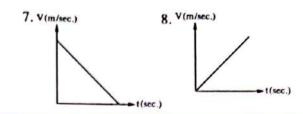
1. The acceleration equals zero.
2. The object moves at a uniform acceleration.
3. The body speed decreases by passing time and the movement is described as decelerating motion.
4. The final speed of the car equals zero and the acceleration of its movement is a deceleration.

9

1. When the object starts its movement from the rest.
2. When the object moves with a deceleration (decreasing acceleration) until it stops.
3. When the object moves with a regular speed.

10

1. $d(m)$
2. $d(m)$

3. Distance
4. $V(km/h)$

5. $V(m/sec.)$
6. $V(m/sec.)$

7. $V(m/sec.)$
8. $V(m/sec.)$

11

1.

P.O.C.	Speed	Acceleration
Definition :	It is the distance moved through a unit time.	It is the change of an object speed through a unit time.
Measuring unit :	(m/sec.) or (km/h)	$(m/sec.^2)$ or (km/h^2)

2.

Uniform speed	Uniform acceleration
It is the speed by which the object moves when it covers equal distances at equal periods of time.	It is the acceleration by which an object moves in a straight line when its speed changes by equal values through equal periods of time.

3.

Positive acceleration (Acceleration)	Negative acceleration (Deceleration)
- It is an acceleration by which an object moves in a straight line when its speed increases by equal values through equal periods of time.	- It is an acceleration by which an object moves in a straight line when its speed decreases by equal values through equal periods of time.
- The final speed of an object > the initial speed.	- The initial speed of an object > the final speed.
- Its value is positive.	- Its value is negative.

12 Physicists use them to :

  - predict the relation between certain physical quantities.

  - understand practical results.

  - describe the physical phenomena in an easier way.

13

1. $\Delta V = 10$ m/sec.

   $V_2 - V_1 = 10$ m/sec.

9

∵ The body moves from rest.

∴ V_1 = Zero.

∴ The final speed = 10 m/sec.

2. Increasing (positive) acceleration.

14

1.

The graph	Vertical axis	Horizontal axis
(A)	Distance	Time
(B)	Distance	Time
(C)	Speed	Time

2. (A) The body is at rest.

(B) The body moves with a decelerating motion.

(C) The body moves with an accelerating motion then at a regular speed. (i.e. acceleration = 0).

(D) The body moves with a uniform speed.

(E) The body moves with an accelerating motion.

(F) The body moves with a zero acceleration (uniform speed).

3. 1. (A)   2. (C)   3. (B)   4. (D)

4. 1. Graph (1) : [AB]

Graph (2) : [YZ]

2. [XY]

3. [BC]

15

1. V_2 = 12 m/sec. V_1 = 6 m/sec.

Δt = 3 sec.

$a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{12 - 6}{3} = 2$ m/sec².

2. (a) $V_1 = 0$ $V_2 = 36$ m/sec. $\Delta t = 9$ sec.

$a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{36 - 0}{9} = 4$ m/sec²

(b) Positive acceleration.

3. $V_1 = 0$ $V_2 = 90$ m/sec. $\Delta t = 10$ sec.

$a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{90 - 0}{10} = 9$ m/sec²

4. (a) $a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{12 - 6}{3} = 2$ m/sec²

(b) Positive acceleration.

5. $V_2 = 36 \times \dfrac{5}{18} = 10$ m/sec.

$V_1 = 0$ $\Delta t = 10$ sec.

$a = \dfrac{V_2 - V_1}{\Delta t}$ ∴ $a = \dfrac{10 - 0}{10} = 1$ m/sec²

Positive acceleration.

6. $V_1 = 54 \times \dfrac{5}{18} = 15$ m/sec.

$V_2 = 36 \times \dfrac{5}{18} = 10$ m/sec.

$a_1 = \dfrac{V_2 - V_1}{\Delta t_1} = \dfrac{10 - 15}{2} = -2.5$ m/sec²

∵ The car moves at a uniform acceleration.

∴ $a_1 = a_2 = -2.5$ m/sec²

$\Delta t_2 = \dfrac{V_2 - V_1}{a_2} = \dfrac{Zero - 15}{-2.5} = 6$ sec.

7. $V_1 = 72 \times \dfrac{5}{18} = 20$ m/sec.

$V_2 = 0$ $\Delta t = 8$ sec.

$a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{0 - 20}{8} = -2.5$ m/sec²

8. 1. (a) : $a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{10 - 0}{4} = 2.5$ m/sec²

(b) : $a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{5 - 10}{2} = -2.5$ m/sec²

2. $t = \dfrac{V_2 - V_1}{a} = \dfrac{0 - 5}{-2.5} = 2$ sec.

9. $V_1 = 40$ m/sec. $V_2 = ?$

$a = -2$ m/sec² $\Delta t = 15$ sec.

∵ $a = \dfrac{V_2 - V_1}{\Delta t}$

$-2 = \dfrac{V_2 - 40}{15}$ ∴ $V_2 = 10$ m/sec.

10. $V_1 = 50$ m/sec. $a = -2$ m/sec²

$\Delta t = 12$ sec. $V_2 = ?$

∵ $a = \dfrac{V_2 - V_1}{\Delta t}$, $-2 = \dfrac{V_2 - 50}{12}$

$V_2 - 50 = -24$ ∴ $V_2 = 26$ m/sec.

11. $V_1 = 20$ m/sec. $V_2 = 0$ $\Delta t = 4$ sec.

$a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{-20}{4} = -5$ m/sec²

It's a decelerating motion (negative acceleration).

12. $V_1 = 40$ m/sec. $V_2 = 0$ $a = -2$ m/sec²

$\Delta t = \dfrac{V_2 - V_1}{a}$ $\Delta t = \dfrac{-40}{-2} = 20$ sec.

13. $a = \dfrac{\Delta V}{\Delta t}$ $4 = \dfrac{28}{\Delta t}$

$\Delta t \times 4 = 28$ $\Delta t = \dfrac{28}{4} = 7$ sec.

14. $V_1 = 0$ $V_2 = 100$ km/h = 27.8 m/sec. $\Delta t = 20$ sec.

$a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{27.8 - 0}{20} = 1.39$ m/sec²

15. (a) $a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{2.5 - 0}{5} = 0.5$ m/sec²

(b) Positive acceleration, because the final speed is greater than the initial speed.

16. $a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{30 - 60}{15} = -2 \text{ m/sec}^2$

    $\Delta t = \dfrac{\Delta V}{a} = \dfrac{0 - 60}{-2} = 30 \text{ sec.}$

17. (a) • For the car :

    $V_1 = 20 \text{ m/sec.}$ $V_2 = 25 \text{ m/sec.}$

    $\Delta t = 2.5 \text{ sec.}$

    $a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{25 - 20}{2.5} = \dfrac{5}{2.5} = 2 \text{ m/sec}^2$

    • For the bike :

    $V_1 = 0$ $V_2 = 5$ $\Delta t = 2.5 \text{ sec.}$

    $a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{5 - 0}{2.5} = 2 \text{ m/sec}^2$

    (b) The car and the bike move with the same acceleration.

18. • For the bike :

    $V_1 = 0$ $V_2 = 5 \text{ m/sec.}$

    $\Delta t = 2.5 \text{ sec.}$

    $a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{5 - 0}{2.5} = 2 \text{ m/sec}^2$

    Positive acceleration.

    • For the car :

    $V_1 = 20 \text{ m/sec.}$ $V_2 = 45 \text{ m/sec.}$

    $\Delta t = 2.5 \text{ sec.}$

    $a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{45 - 20}{2.5} = 10 \text{ m/sec}^2$

    Positive acceleration.

19. $\because a = \dfrac{V_2 - V_1}{t}$

    $a = \dfrac{0 - 27}{10} = -2.7 \text{ m/sec}^2$

20. $\because a = \dfrac{V_2 - V_1}{\Delta t}$ $\therefore 4 = \dfrac{V_2 - 0}{6}$

    $V_2 - 0 = 4 \times 6$ $V_2 = 24 \text{ m/sec.}$

21. • For the car :

    $V_1 = 60 \text{ m/sec.}$ $V_2 = 65 \text{ m/sec.}$ $\Delta t = 2.5 \text{ sec.}$

    $a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{65 - 60}{2.5} = 2 \text{ m/sec}^2$

    • For the bike :

    $V_1 = 0$ $V_2 = 5 \text{ m/sec.}$ $\Delta t = 1 \text{ sec.}$

    $a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{5 - 0}{1} = 5 \text{ m/sec}^2$

    $\therefore$ The bike moves with a greater acceleration.

22. $V_1 = 20 \text{ m/sec.}$ $V_2 = 0$

    $a = -1 \text{ m/sec}^2$ $\Delta t = ?$

    $\because a = \dfrac{V_2 - V_1}{\Delta t}$

    $-1 = \dfrac{-20}{\Delta t}$

    $\therefore \Delta t = \dfrac{-20}{-1} = 20 \text{ sec.}$

23. (a) $\because a = \dfrac{V_2 - V_1}{t}$

    $\therefore V_2 = (a \times t) + V_1$

    $= \dfrac{10}{t} \times t + 0 = 10 \text{ m/sec.}$

    (b) Positive acceleration.

24. (a) $a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{10 - 0}{2} = 5 \text{ m/sec}^2$

    (b) $\because a = \dfrac{V_2 - V_1}{\Delta t}$

    $\therefore V_2 - V_1 = a \times \Delta t$

    $V_2 - 0 = 5 \times 5$

    $V_2 = 25 \text{ m/sec.}$

    (c) $a = \dfrac{V_2 - V_1}{\Delta t}$

    $\therefore \Delta t = \dfrac{V_2 - V_1}{a} = \dfrac{40 - 0}{5} = 8 \text{ sec.}$

25. (a) – During the first hundred metres :

    Acceleration = Zero.

    (Because the car moves at a regular speed).

    (b) – During the first hundred metres :

    $V = \dfrac{d}{t} = \dfrac{100}{5} = 20 \text{ m/sec.}$

    – During the second twenty metres :

    $V_1 = 20 \text{ m/sec.}$ $V_2 = 0$ $\Delta t = 2 \text{ sec.}$

    $a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{0 - 20}{2} = -10 \text{ m/sec}^2$

    (c) Negative acceleration.

26. (a) The car moves by a uniform speed so acceleration equals zero.

    (b) $V_2 = \text{Zero}$ $V_1 = \dfrac{80}{4} = 20 \text{ m/sec.}$ $\Delta t = 4 \text{ sec.}$

    $a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{0 - 20}{4} = -5 \text{ m/sec}^2$

27. (a) $V_1 = 72 \times \frac{5}{18} = 20$ m/sec.

$V_2 = 54 \times \frac{5}{18} = 15$ m/sec.

$a_1 = \frac{V_2 - V_1}{\Delta t} = \frac{15 - 20}{10} = -0.5$ m/sec^2

(b) Negative acceleration.
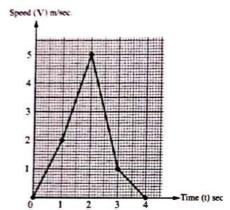
(c) ∵ The object moves with a uniform acceleration.

∴ $a_1 = a_2 = -0.5$ m/sec^2

$V_1 = V_2 - [a \times \Delta t]$

$= 15 - [-0.5 \times (5 + 10)] = 22.5$ m/sec.

28. The graphic relationship [speed - time].

Speed (V) m/sec.

29. $a = \frac{V_2 - V_1}{\Delta t}$

V_2 (the second car) $= 10 + (5 \times 5) = 35$ m/sec.

Relative speed of first car $= V_1 + V_2 = 30 + 35$

$= 65$ m/sec.

30. (a) Regular speed.

(b) V_1 (For body A) $= \frac{6}{3} = 2$ m/sec.

V_2 (For body B) $= \frac{6}{6} = 1$ m/sec.

∴ The ratio between the speed of body

(A) : the speed of body (B) $= 2 : 1$

31. (a) 20 m.   (b) 3 sec.

(c) $V = \frac{d}{t} = \frac{25}{5} = \frac{20}{4} = \frac{15}{3} = \frac{10}{2} = \frac{5}{1} = 5$ m/sec.

Regular speed.
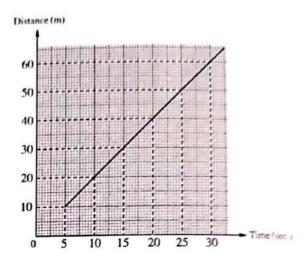
32. (a) (1) 0.5 sec.   (2) 100 m/sec.   (3) 200 m.
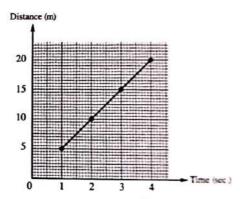
(b) Zero acceleration.

33. (a)

Distance (m)
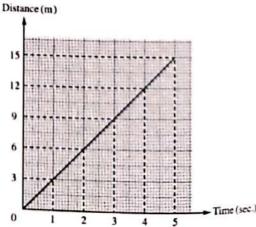
(b) $V = \frac{d}{t} = \frac{20}{10} = 2$ m/sec.

34. (a)

Distance (m)
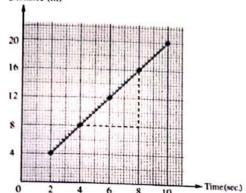
(b) Yes, because the ratio $\frac{d}{t}$ is constant which represents the car speed, and the relationship is a straight line.

(c) The speed of the car $= \frac{d}{t} = \frac{10}{2} = 5$ m/sec.

(d) Acceleration of the car = Zero.

35. (a)

Distance (m)
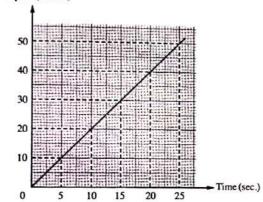
(b) Body speed $= \frac{3}{1} = \frac{6}{2} = \frac{9}{3} = 3$ m/sec.

36. (a) Distance (m)
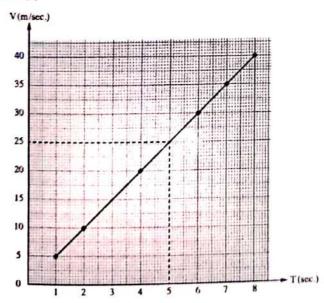
(b) Body speed $= $ Slope $= \dfrac{16-8}{8-4} = \dfrac{8}{4} = 2$ m/sec.

37. (a) Speed (m/sec.)

(b) $a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{50 - 0}{25} = 2$ m/sec^2.

38. (a)

V (m/sec.)

(b) 1. $V = 25$ m/sec.

2. $a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{40 - 5}{8 - 1} = 5$ m/sec^2.

39. (a) 30 m/sec.

(b) The train moves at a uniform speed of regular motion.

(c) At 2.5 second (at point C).

(d) 1. The part (AB).   2. The part (CD).

40. (a) $V = 10$ m/sec. $t = 4$ sec.

$\therefore d = V \times t = 40$ m.

(b) $V_{max} = 30$ m/sec.

(c) $V_1 = 30$ m/sec. $V_2 = 0$ $\Delta t = 12 - 8 = 4$ sec.

$\because a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{-30}{4} = -7.5$ m/sec^2.

$\therefore$ It's decelerating motion.

41. (a) The fourth – 40

(b) $a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{40 - 0}{4} = 10$ m/sec^2

42. (a) Acceleration for (AB) $= \dfrac{\Delta V}{\Delta t}$

$= \dfrac{20 - 0}{4 - 0} = 5$ m/sec^2.

Acceleration for (BC) $= \dfrac{0 - 20}{6 - 4} = \dfrac{-20}{2}$

$= -10$ m/sec^2.

(b) (AB) Positive acceleration.

(BC) Negative acceleration.

43. (a) The train moves at a uniform speed of regular motion.

(b) $a = \dfrac{\Delta V}{\Delta t} = \dfrac{0 - 60}{9 - 7} = \dfrac{-60}{2} = -30$ m/sec^2.

Negative acceleration.

44. (a) Time interval (BC) $= 5 - 2 = 3$ sec.

(b) $a_{AB} = \dfrac{\Delta V}{\Delta t} = \dfrac{40 - 0}{2 - 0} = 20$ m/sec^2.

$a_{CD} = \dfrac{\Delta V}{\Delta t} = \dfrac{0 - 40}{6 - 5} = -40$ m/sec^2.

45. (a) 60   **(b)** Negative acceleration.

46. (a) 1. 20   2. zero   3. 5

(b) 1. 15   2. 25

Answers of Timss

1 (!)

2 This means that the body moves with a uniform speed equals 20 m/sec.

3
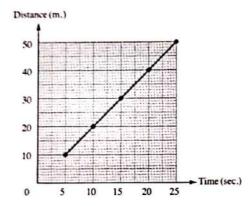
(a) When the amount of acceleration of the object (a) equals one m/sec^2.

(b) When the change in time (Δt) equals one sec.

13

4
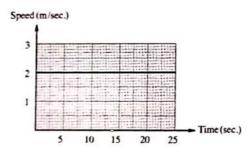
(a) The object (X).

(b) $a = \dfrac{V_2 - V_1}{\Delta t}$

* Acceleration of object (X) = $\dfrac{8-0}{4}$ = 2 m/sec²

* Acceleration of object (Y) = $\dfrac{8-4}{4}$ = 1 m/sec²

∴ The object (X) moves at a greater acceleration than the object (Y).

(c) * After 4 sec. from the beginning of motion

  * V = 8 m/sec.

5

(a)

Distance (m.)
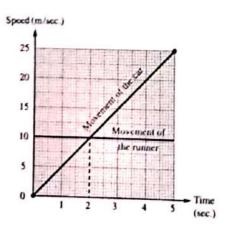
(b) $V = \dfrac{d}{t} = \dfrac{10}{5} = \dfrac{20}{10} = \dfrac{30}{15} = \dfrac{40}{20} = \dfrac{50}{25}$ = 2 m/sec.

Speed (m/sec.)

(c) d = V × t = 2 × 30 = 60 m.

6

(a)

Speed (m/sec.)

14
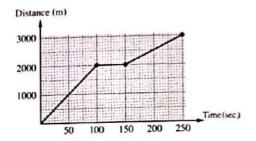
(b) (1) d = V × t = 10 × 5 = 50 m.

  (2) 2 sec.

7 The object moves with a non-uniform speed and it moves at a uniform acceleration, its value is constant.

8 The graphic relationship (distance – time).

Distance (m)

Lesson **3**

1

1. a	2. c	3. b	4. b	5. d	6. c
7. b	8. c	9. b	10. a	11. d	12. a
13. a	14. b	15. d	16. c	17. b	
18. (A) c (B) d	19. a	20. c	21. a	22. b	
23. c	24. b	25. c	26. d	27. a	

2

1. d   2. b   3. a   4. c

3

1. displacement   2. scalar
3. time   4. force
5. scalar – vector   6. scalar
7. Velocity   8. 1 m/sec.
9. direction.
10. magnitude and direction
11. Displacement
12. magnitude and direction.
13. velocity.   14. force
15. Distance   16. displacement
17. 20 m   18. zero.
19. straight   20. average velocity.
21. metre.   22. displacement.
23. m/sec.   24. Cheetah
25. velocity

4

1. Scalar physical quantity.
2. Scalar physical quantities.

3. Vector physical quantity.
4. Acceleration.
5. Displacement.
6. Velocity.
7. Acceleration.
8. The amount of displacement.
9. Distance.
10. & 11. Velocity.
12. Cheetah.

8. Because the direction of wind affects the velocity of the plane and hence the time of the trip and the amount of fuel consumed.

5

1. scalars – vectors.
2. Scalar physical quantity
3. scalar – km/h. or m/sec. 4. vector – scalar
5. metre – m/sec².
6. Vector physical quantity
7. vector – m/sec². 8. speed – velocity.
9. Force – velocity
10. vector physical – scalar physical
11. displacement. 12. vector – scalar
13. scalar – vector 14. distance.
15. displacement. 16. amount of displacement.
17. the direction of the object movement.
18. Distance – displacement
19. straight – one direction. 20. Displacement
21. speed – displacement 22. $\dfrac{\text{Displacement}}{\text{Total time}}$
23. Cheetah – 27
24. direction – different or (m and m/sec.).
25. Velocity – vector
26. 12 m/sec. – 12 m/sec. in $\overrightarrow{AB}$ direction.
27. 50 m. – 70 m.
28. zero.
29. more – fuel – resistance.

6

(1) 20 (2) 12

7

1. Because they have magnitude only and have no direction.
2. Because it is determined by magnitude and direction.
3. Because distance is determined by magnitude only, while displacement is determined by magnitude and direction.
4. Because it is determined by magnitude and direction.
5. Because it is identified by magnitude and direction.
6. Because its displacement is zero.
7. Because the plane that flies against the wind direction, its velocity decreases and consumes more fuel and takes more time than that flies in the same wind direction.

8

1. This means that to describe the length, it is enough to know its magnitude only and its measuring unit.
2. This means that to describe the force, it is necessary to know its magnitude, its measuring unit and its direction.
3. This means that the final position of the movement of this body is the same primary position.
4. This means that the distance covered in the east direction from primary position of movement towards its final position equals 50 metres.
5. This means that the body moves in a straight line in one direction.
6. $\overrightarrow{V} = \dfrac{\overrightarrow{d}}{t} = \dfrac{40}{20} = 2$ m/sec. northward

This means that the average velocity of this body equals 2 m/sec. in the northward direction.
7. This means that the displacement of the object equals 30 m in the east direction.
8. This means that the displacement equals 5 m.

9

1. It is the physical quantity that has magnitude only and has no direction.
2. It is the physical quantity that has magnitude and direction.
3. It is the actual length of the path that a moving object covers from the starting point to the ending point.
4. It is the shortest distance that is covered by an object in a certain direction between the starting point and the ending point.
5. It is the rate of change of displacement.

10

1. When the body moves in a straight line in one direction.
2. When the body returns to its primary position of its movement (i.e. the final position of the movement is the same primary position of it).
3. When the final position of the movement is the same primary position of the body, the displacement equals zero.

15

11

1.

P.O.C.	Scalar physical quantity	Vector physical quantity
Definition :	It is the physical quantity that has magnitude only and has no direction.	It is the physical quantity that has magnitude and direction.
Examples :	Mass - Length - Speed - Time.	Acceleration - Force - Velocity - Displacement.

2. *Look at the main book on page (83).*

3. *Look at the main book on page (85).*

4.

Mass	Force
It is a scalar physical quantity.	It is a vector physical quantity.

5.

P.O.C.	Uniform speed	Velocity
The mathematical relation :	Uniform speed (V) = $\dfrac{\text{Distance (d)}}{\text{Time (t)}}$	Velocity ($\vec{V}$) = $\dfrac{\text{Displacement }(\vec{d})}{\text{Time (t)}}$

6.

Displacement	Acceleration
It is the distance covered at a constant direction from the primary position of movement towards its final position.	It is the change of an object speed in one second in a specific direction.

12 1 & 4 are vector physical quantities.

2 & 3 are scalar physical quantities.

13

1. (a) The distance covered

= 10 + 5 + 5 = 20 metres.

(b) The displacement

= 10 metres downward.

2.

P.O.C.	I	My colleague
(a) Distance :	5 metres	5 metres
(b) Displacement :	5 metres northward	5 metres southward

3. (a) 20 m/sec. northward.

(b) $a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{20 - 5}{3} = \dfrac{15}{3} = 5$ m/sec²

4. Displacement = 8 − 5 = 3 m.

Direction of displacement to the east.

5. (a) Total distance covered by the body

= AB + BC = 4 + 1 = 5 metres.

(b) The displacement = AB − BC = 4 − 1 = 3 metres in east direction.

(c) The velocity = $\dfrac{\text{Displacement}}{\text{Time}} = \dfrac{3}{10} = 0.3$ m/sec.

6. Displacement = 600 m.　　　　Time = 60 sec.

Average velocity = $\dfrac{\text{Displacement}}{\text{Total time}} = \dfrac{600}{60} = 10$ m/sec.

in eastward direction.

7. (a) Total distance = $\dfrac{1}{2}(2\pi r) = \dfrac{1}{2}\left(2 \times \dfrac{22}{7} \times 7\right)$

$= \dfrac{1}{2} \times 44 = 22$ m.

(b) Displacement = 2r = 2 × 7 = 14 m.

in the west direction $(\overrightarrow{AC})$.

(c) Velocity $= \dfrac{\text{Displacement}}{\text{Time}} = \dfrac{14}{3.5} = 4$ m/sec.

in the west direction $(\overrightarrow{AC})$.

8. (a) Distance from D to F = $\dfrac{1}{2} \times 2\pi r$

$= \dfrac{1}{2} \times 2 \times \dfrac{22}{7} \times 7 = 22$ m.

∴ The covered distance = 8 + 22 + 7

= 37 metre

(b) Velocity = $\dfrac{\text{Displacement}}{\text{Time}} = \dfrac{8 + 7}{5} = 3$ m/sec.

9. (a) The circumference of circle

$= 2\pi r = 2 \times 3.14 \times 10 = 62.8$ m.

Distance covered = $\dfrac{1}{4}$ Circumference of circle +

Diameter of circle + $\dfrac{1}{4}$ Circumference of circle
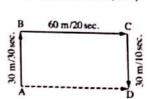
$= \left(\dfrac{1}{4} \times 62.8\right) + (2 \times 10) + \left(\dfrac{1}{4} \times 62.8\right)$

$= 15.7 + 20 + 15.7 = 51.4$ m.

(b) Displacement = Diameter of circle = 2 × 10

= 20 m in southward direction $(\overrightarrow{AD})$.

10. (a) Total distance

= 30 + 60 + 30

= 120 m.

(b) Displacement

= 60 m in the eastward direction.

Average velocity = $\dfrac{\text{Displacement}}{\text{Total Time}} = \dfrac{60}{60} = 1$ m/sec.

in the eastward direction.

11. (a) Displacement = Zero.

Total time = 30 + 30 = 60 min = 1h.

$$\text{Velocity} = \frac{\text{Displacement}}{\text{Total time}} = \frac{\text{Zero}}{1} = \text{Zero.}$$

(b) Average speed $= \frac{\text{Distance}}{\text{Time}} = \frac{40+40}{1} = 80$ km/h.

12. axis (1) is time axis.

axis (2) is speed axis.

13. (a) Distance = AB + BC = 40 + (40 − 20) = 60 m.

$$\text{Speed} = \frac{d}{t} = \frac{60}{12} = 5 \text{ m/sec.}$$

(b) $\text{Velocity} = \frac{\text{Displacement}}{\text{Time}} = \frac{20}{12} = 1.67$ m/sec.

(c) a = Zero.

14. (a) Total distance = 10 + 10 = 20 m.

(b) Displacement = zero

(c) Velocity $= \frac{10}{5} = 2$ m/sec.

15. (a) (AB) : Accelerating motion.

$$a = \frac{20-0}{10} = 2 \text{ m/sec}^2.$$

(BC) : Zero acceleration.

$$a = 0$$

(CD) : Decelerating motion.
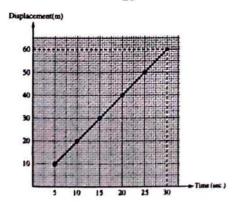
$$a = \frac{0-20}{5} = -4 \text{ m/sec}^2.$$

(b) (1) Displacement = V × t = 20 × 5 = 100 m.

(2) Average speed $= \frac{200 + 100 + 100}{10 + 5 + 5}$

$$= \frac{400}{20} = 20 \text{ m/sec.}$$

16. (a)

(b) Velocity $= \frac{60}{30} = 2$ m/sec.

17. (a) Total distance = 20 + 40 + 20 + 40 = 120 m.

(b) Average speed $= \frac{\text{Total distance}}{\text{Total time}}$

$$= \frac{120}{2+4+2+4} = \frac{120}{12}$$

$$= 10 \text{ m/sec.}$$

(c) Displacement = Zero.

(d) Velocity = Zero.

18. (a) The time that the second car takes (t)

$$= \frac{d}{V} = \frac{200}{20} = 10 \text{ sec.}$$

∴ The second car reaches first to point (D) because it took a short time.

(b) Velocity $= \frac{\text{Displacement}}{\text{Time}} = \frac{200}{20}$

$$= 10 \text{ m/sec. in the east direction.}$$
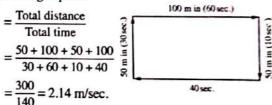
19. (a) Total distance = 50 + 60 + 40 + 90 = 240 m.

Total time = 30 + 40 + 20 + 60 = 150 sec.

Average speed $= \frac{\text{Total distance}}{\text{Total time}}$

$$= \frac{240}{150} = 1.6 \text{ m/sec.}$$

(b) Displacement = Zero.

(c) Acceleration = Zero.

20. (a) Total distance = 50 + 100 + 50 + 100 = 300 m.

(b) Average speed

$$= \frac{\text{Total distance}}{\text{Total time}}$$

$$= \frac{50 + 100 + 50 + 100}{30 + 60 + 10 + 40}$$

$$= \frac{300}{140} = 2.14 \text{ m/sec.}$$

(c) Displacement = Zero.

(d) The average velocity = Zero.

21. (a) 50 m in the direction $(\overrightarrow{AC})$.

(b) 20 sec. (c) 40 + 30 = 70 m.

(d) $\frac{50}{20} = 2.5$ m/sec. in the direction $(\overrightarrow{AC})$.

22. (a) Distance = 30 + 40 = 70 m.

(b) Average speed $= \frac{\text{Total distance}}{\text{Total time}} = \frac{70}{7} = 10$ m/sec.

23. (a) Distance = 100 + 50 = 150 m.

(b) Displacement = 50 m. in the direction $(\overrightarrow{AC})$.

(c) Velocity $= \frac{\text{Displacement}}{\text{Total time}} = \frac{50}{20+5} = \frac{50}{25} = 2$ m/sec.

in the direction $(\overrightarrow{AC})$.

24. (a) Average speed $= \frac{d}{t} = \frac{70}{5} = 14$ m/sec.

(b) Average velocity $= \frac{\text{Displacement}}{\text{Total time}}$

$$= \frac{50}{5} = 10 \text{ m/sec. in the direction } (\overrightarrow{AC}).$$

25. (a) Total distance = 80 + 200 + 40 + 160 + 40

$$= 520 \text{ m.}$$

Scanned with CamScanner

(b) Displacement = 200 − 160 = 40 m.

in the direction $(\overrightarrow{AF})$.

(c) Velocity = $\dfrac{\text{Displacement}}{\text{Total time}} = \dfrac{40}{10} = 4$ m/sec.

in the direction $(\overrightarrow{AF})$.

26. (a) Total distance = 7 + 2 + 4 + 3 + 3 = 19 m.

(b) Displacement = 2 + 3 = 5 m in the direction $(\overrightarrow{AF})$.

27. (a) Total distance = 40 + 80 + 40 = 160 m.

(b) Total time = 20 + 20 + 10 = 50 sec.

(c) Displacement = 80 m. in the direction eastward $(\overrightarrow{AD})$.

(d) Average velocity = $\dfrac{\text{Displacement}}{\text{Total time}} = \dfrac{80}{50}$

= 1.6 m/sec.

in the direction eastward $(\overrightarrow{AD})$.

28. (a) The displacement = 40 − 10 = 30m.

in southward direction $(\overrightarrow{AE})$.

(b) Speed in AB = $\dfrac{d}{t} = \dfrac{10}{2} = 5$m/sec.

Speed in BC = $\dfrac{30}{10} = 3$m/sec.

Speed in CD = $\dfrac{40}{8} = 5$m/sec.

Speed in DE = $\dfrac{30}{5} = 6$m/sec.

∴ The person moves with the least speed in the part (BC).

29. (a) 22

(b) 14 − $(\overrightarrow{AC})$.

(c) $\dfrac{14}{10} = 1.4 - (\overrightarrow{AC})$.

30. (a) d = 1.5 × The circumference of the circle

= 1.5 × 44 = 66 m.

(b) $\vec{d}$ = Diameter of the circle

= 7 + 7 = 14 m.

(c) Speed = $\dfrac{d}{t} = \dfrac{66}{6}$

= 11 m/sec.

(Answers of Timss)

1 When they have the same measuring units.

2 6 km in the southward direction.

3 Displacement = 10 cm in the southward $(\overrightarrow{AH})$ direction.

Distance = 7 × 10 = 70 cm.

4 (a) d   (b) c

5 (a) Distance = The perimeter of the circle = 300 m.

(b) Time = 10 + 20 = 30 sec.

Speed = $\dfrac{\text{Distance}}{\text{Time}} = \dfrac{300}{30} = 10$ m/sec.

(c) Displacement = Zero.

6 Circle area = πr^2

$154 = \dfrac{22}{7} r^2$

∴ r = 7 cm.

The distance of :

(a) FA + AD = 28 + 28 = 56 cm.

(b) BC + CF + FD = 14 + 14 + 28 = 56 cm.

(c) CA + AB = 14 + 14 = 28 cm.

(d) FC + CB + BD = 14 + 14 + 14 = 42 cm.

(e) FC + CB + BA = 14 + 14 + 14 = 42 cm.

The displacement of :

(a) 28 cm in the direction $(\overrightarrow{FD})$.

(b) 14 cm in the direction $(\overrightarrow{BD})$.

(c) 14 cm in the direction $(\overrightarrow{CB})$.

(d) 28 cm in the direction $(\overrightarrow{FD})$.

(e) 28 cm in the direction $(\overrightarrow{FA})$.

7 2 m eastward from starting point.

Project On UNIT One *Answer by Yourself*

Unit Two

Lesson 1

1

1. c	2. d	3. a	4. a	5. b	6. c
7. d	8. d	9. b	10. d	11. c	12. b
13. a	14. a	15. b	16. d	17. c	18. c
19. d	20. b	21. c	22. c	23. b	24. d
25. b	26. b	27. d	28. c	29. a	30. c
31. b	32. d	33. d	34. d	35. a	36. b
37. b	38. b	39. a	40. c	41. b	42. a
43. d	44. d	45. b	46. b	47. d	48. a
49. b	50. b	51. c	52. c	53. d	54. d
55. d					

2 1. e 2. d 3. f 4. b 5. a

3

1. light reflection
2. reflecting.
3. reflected ray
4. 70°
5. 50°
6. zero.
7. zero°
8. equal to
9. virtual and erect.
10. laterally inverted
11. 60°
12. plane
13. 4 m.
14. pole
15. pole of the mirror.
16. 10 cm.
17. principal axis
18. plane mirror
19. converging. 20. 2
21. 10 cm.
22. 3 cm
23. 20 cm.
24. Real image
25. virtual
26. the focus of the mirror.
27. parallel to the principal axis.
28. on itself.
29. behind
30. centre of curvature. 31. real, inverted
32. real, inverted and magnified.
33. diminished.
34. a distance greater than the focal length and smaller than the double of the focal length.
35. equal.
36. plane.

4

1. Light reflection phenomenon.
2. First law of light reflection.
3. Second law of light reflection.
4. The incident light ray.
5. The reflected light ray.
6. Angle of incidence.
7. Angle of reflection.
8. Plane mirror.
9. Spherical mirror.
10. Concave mirror.
11. Convex mirror.
12. Convex mirror.
13. The pole of the mirror.
14. Radius of mirror curvature.
15. The principal axis of the mirror.
16. Centre of mirror curvature.
17. The secondary axis.
18. Focus of the mirror.
19. Focal length of the mirror.
20. Parallel light rays.
21. Archimedes.
22. Real image.
23. Virtual image.
24. Concave mirror.
25. Convex mirror.
26. Concave mirror.

5
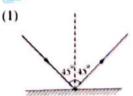
1. light reflection.
2. (a).
3 (b). 2
3. 55° – 110°
4. 50°
5. 60°
6. zero°.
7. 6 – 2
8. 60 cm – 8
9. equal to – perpendicular
10. reflecting – plane – spherical.
11. a hollow sphere – concave – convex.
12. inner – converges
13. Convex
14. the pole of the mirror.
15. in front of – behind
16. the principal axis of the mirror.
17. the centre of curvature of the mirror.
18. the pole of the mirror – the centre of mirror curvature.
19. secondary.
20. the focal length of the mirror.
21. r
22. twice
23. parallel to the principal axis – on itself.
24. zero.
25. the focus.
26. the object – its reflecting surface.
27. focus – centre of curvature.
28. more than the double – inverted
29. more - less
30. a concave
31. 10
32. 8
33. real.
34. virtual.
35. convex – erect
36. twice
37. 40 cm.
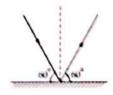
6

(1)

(2)

(3)

(4)

19

(5)   (6)

(7)   (8)

(9)   (10)

7
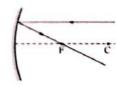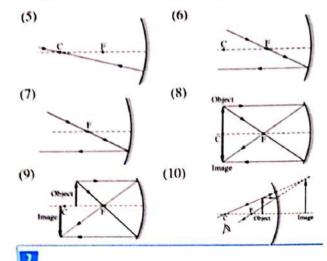
1. Due to light reflection.
2. Because the angle of incidence equals the angle of reflection equals zero.
3. Because the angle of incidence equals zero.
4. Because it cannot be received on a screen.
5. Because it is a virtual image.
6. Because the mirrors of the cars in front of the ambulance car, form a laterally inverted image for this word, and thus it appears laterally corrected to the drivers.
7. Because the images formed by the plane mirror are laterally inverted (reversed).
8. Because its inner surface is a concave mirror, while its outer surface is a convex mirror.
9. Because concave mirror collects light rays that fall on its surface, while convex mirror diverges light rays that fall on its surface.
10. It has one principal axis, because it has one centre of curvature and one pole, while it has uncountable number of secondary axes, because any straight line passes by its centre of curvature and any point on its surface except the pole is considered as a secondary axis.
11. Because the concave mirror collects the reflected light rays falling on it in one point (focus) generating high heat energy.
12. Because focal length = $\frac{1}{2}$ × radius of curvature.
13. Because it falls perpendicular to the spherical mirror, so its incidence angle equals reflecting angle equals zero.
14. *Look at the main book on page (123)*
15. Because this focus is produced due to the collection of the extensions of the reflected rays, cannot be received on a screen and lies behind the mirror.

16. Because wherever the position of the object in front of the convex mirror, its image formed behind the mirror from the intersection of the extensions of the reflected light rays, can't be received on a screen and lies behind the mirror.
17. Because it is a virtual image which is formed behind the mirror as a result of the intersection of the extensions of the reflected light rays and lies behind the mirror.
18. Because it forms an erect and smaller image for the way behind the car.
19. Because real image is formed in front of the mirror from the intersection of the reflected light rays, while virtual image is formed behind mirror from the intersection of the extensions of the reflected light rays.

8

1. It is the phenomenon of the light bouncing off in the same medium when it meets the reflecting surface.
2. Angle of incidence = Angle of reflection.
3. The incident light ray, the reflected light ray and the normal to the surface of reflection at the point of incidence all lie in one plane perpendicular to the reflecting surface.
4. It is the light ray that falls on the reflecting surface.
5. It is the light ray that bounces (returns back) from the reflecting surface.
6. It is the angle between the incident light ray and the normal.
7. It is the angle between the reflected light ray and the normal.
8. It is a mirror that its reflecting surface is a part of a hollow sphere.
9. It is the centre of the sphere that the mirror is considered as a part of it.
10. It is the centre of the sphere from which the mirror is a part of it, and it lies behind the reflecting surfac.
11. It is the radius of the sphere that the mirror is a part of it.
12. It is the point that is in the middle of the reflecting surface of the mirror.
13. It is the straight line that passes by the pole (P) of the mirror and its centre of curvature (C).
14. It is any straight line that passes by the centre of curvature of the mirror and any point on its surface except the pole of the mirror.

15. It is the point of collection of the reflected light rays (in the concave mirror), or their extensions (in the convex mirror).

16. It is the distance between the focus of the concave mirror (F) and its pole (P).

17. It is the image that can be received on a screen.

18. It is the image that cannot be received on a screen.

9

1. It is the phenomenon of the light bouncing off (returning back) in the same medium, when it strikes a reflecting surface.

2. The angle between the incident light ray and the normal equals 60°.

3. The angle between the reflected light ray and the normal equals 30°

4. This means that the incident light ray falls perpendicular on the plane mirror.

5. This means that the image can't be received on a screen.

6. The focal length of this mirror equals 4 cm or the radius of the sphere that the mirror is a part of it equals 8 cm.

7. The distance between the focus of the concave mirror and its pole equals 10 cm or the radius of curvature equals 20 cm.

8. This means that the focal length of a spherical mirror equals 20 cm.

10

1. The angle of incidence of a light ray = Its angle of reflection.

2. The focal length $(f) = \frac{1}{2} \times$ radius of curvature (r).

3. The distance between an object from a plane mirror = the distance between its image and the mirror.

11
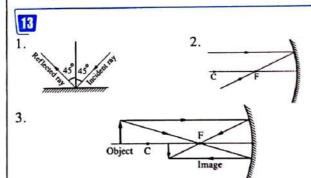
1. The angle of reflection of the light ray increases from 20° to 50°.

2. It reflects on itself.

3. It reflects by an angle equals 35°.

4. The light ray reflects by an angle = 30°.

5. When the body move close to the mirror, the image will move close to the mirror also, where the distance between the image and the mirror = the distance between the object and the mirror.

6. It reflects parallel to the principal axis.

7. It reflects passing through the focus.

8. It reflects on itself.

9. A real, inverted and equal image is formed at the centre of curvature.

10. A virtual, erect and magnified image is formed behind the mirror.

11. A real, inverted and enlarged image is formed after the centre of curvature.

12. A virtual, erect and diminished image of the object is formed behind the mirror.

13. An equal image is formed in the plane mirror, so the driver doesn't see the whole way behind him.

12
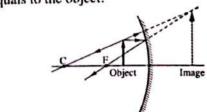
1. When this light ray falls parallel to the principal axis of the concave mirror.

2. This image is formed as a result of the presence of an object in front of a convex mirror at any distance.

3. When the object is put in the centre of carvature of the mirror.

4. When this light ray falls perpendicular to the reflecting surface of the plane mirror.

5. When it is fall passing through the centre of curvature.

13

1.

2.

3.

Properties of the formed image : real , inverted and smaller than the object.

4.

Properties of the formed image : real , inverted and equals to the object.

5.
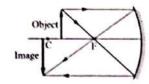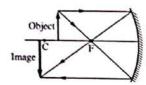
Properties of the formed image : virtual , erect and magnified.

6.
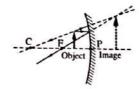
(1) The type of the mirror is concave mirror.

(2) The position of the image is at a distance greater than the double of the focal length
– Its properties : real, inverted and magnified.

7.

Properties of the formed image : real , inverted and magnified.

8.

14

1. *Look at the main book on pages (110 & 111)*
2. *Look at the main book on page (113)*
3. *Look at the main book on pages (119 & 120)*
4. *Look at the main book on page (123)*

15

1.

First law of light reflection	Second law of light reflection
Angle of incidence equals angle of reflection.	The incident light ray, the reflected light ray and the normal to the reflecting surface at the point of incidence, all lie in one plane perpendicular to the reflecting surface.

2.

Concave mirror (converging mirror)	Convex mirror (diverging mirror)
– A mirror, its reflecting surface is a part of the inner surface of the sphere.	– A mirror, its reflecting surface is a part of the outer surface of the sphere.
– It converges (collects) light rays that fall on its surface.	– It diverges light rays that fall on its surface.

3.
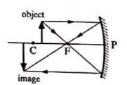
Principal axis of a concave mirror	Secondary axis of a concave mirror
• It is the straight line that passes by the pole (P) of the mirror and its centre of curvature (C).	• It is any straight line that passes by the centre of curvature of the mirror (C) and any point on its surface except the pole of the mirror.
• There is only one principal axis for the mirror.	• There is uncountable number of secondary axes for the mirror.

4.

Real image	Virtual image
1. It is formed as a result of the intersection of the reflected light rays.	1. It is formed as a result of the intersection of the extensions of the reflected light rays.
2. It can be received on a screen.	2. It cannot be received on a screen.
3. It is always inverted.	3. It is always erect.

16

1.

The distance between the object and the mirror is more than 2 cm. (the focal length) but less than 4 cm (the radius of curvature).

2. The angle of incidence = the angle of reflection
$$= \frac{140°}{2} = 70°$$

3. (a) The angle of incidence $= \frac{120°}{2} = 60°$

(b) The angle between the incident ray and the reflecting surface $= 90° - 60° = 30°$

4. a. The distance between the person and the mirror = the distance between his image and the mirror.
So, the distance between the person and his image $= 3 \times 2 = 6$ metres.

b. The properties of the image :
(1) Upright (erect).
(2) Equal to the object in size.
(3) Laterally inverted (reversed).
(4) Virtual (the image cannot be received on a screen).

5. The distance between the person and the mirror
   = the distance between his image and the mirror.
   So, he must move 7 metres, so that the distance
   between him and his image becomes 6 metres.

6. Radius of curvature (r) = $\frac{1}{2}$ diameter

   $r = \frac{20}{2}$ = 10 cm.

   The focal length (f) = $\frac{1}{2}$ × radius of curvature (r)

   $f = \frac{10}{2}$ = 5 cm.
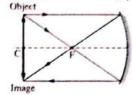
17

1. • **First law** : Angle of incidence = angle of reflection.

   • **Second law** : The incident light ray, the reflected
     light ray and the normal to the surface of reflection
     at the point of incidence all lie in one plane
     perpendicular to the reflecting surface.

2. (a) When the incident light ray falls perpendicular
       on a reflecting surface.

   (b) When the incident light ray falls passing through
       the centre of the mirror curvature.

3. • Plane mirrors.
   • Spherical mirrors :
     a. concave mirror.   b. convex mirror.

4. *Look at the main book on page (113)*

5. The scientist Archimedes.

6. – The properties of the image : The image is smaller
     than the object, upright and virtual.

   – The use of the mirror : It is used as side–view
     mirror on the passenger's side of a car.

7. (a) The position of the object is :
       Between the focus (F) and the centre of curvature (C)
       [at a distance more than the focal length but less
       than the radius of curvature].

   (b) The position of the object is : Between the focus
       (F) and the pole (P)
       [at a distance less than the focal length].

   (c) The position of the object is :
       After the centre of curvature(C) [at a distance
       greater than the radius of curvature or more than
       the double of the focal length].

8. – The tools :
   • A concave mirror.
   • A holder for the mirror.
   • A light box with a hole.
   • A ruler.

– The relation :
   The radius of mirror curvature (r) = 2 × the focal
   length.
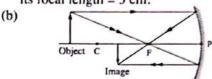
9. *Look at the main book on pages (124 & 125)*
10. *Look at the main book on page (126)*
11. (a) Concave mirror.   (b) 10 cm.
    (c)

12. (a) The type of mirror is concave mirror,
        its focal length = 3 cm.
    (b)

13. (a)

    (b) Properties of the formed image : Real, inverted
        and equal to the object.

14. (1) b   (2) d   (3) a
15. (a) – Concave mirror.
        – Between the focus (F) and the pole (P).
    (b) No, because it is a virtual image.
16. (1) Concave mirror
        – It focal length = $\frac{42}{4}$ = 10.5 cm.
    (2)
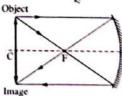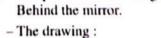
17. (a)

    (b) - Real, inverted and equal to the object.
        - Length of the image = 5 cm.
        - Radius of the mirror = 8 cm.
18. – The position of the image :
      Behind the mirror.
    – The drawing :
    – Its characteristics :
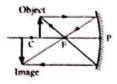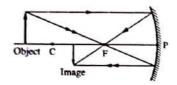
      • Virtual.
      • Upright (Erect).
      • Magnified.

19. (a)

(b) The image : Real, inverted and magnified.

20. (a)
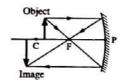
(b) The image : real , inverted and diminished.

21. (a) The focal length of the mirror = 20 cm.

(b) Real, inverted and magnified.

(c)
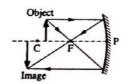
22. (a) Concave mirror.

(b) Greater than the double of the focal length.

(c) Real, inverted and enlarged.

(d)

23. (a) Concave mirror.　(b) 50 cm.　(c) 200 cm.

24. – virtual　　– erect　　– diminished

18
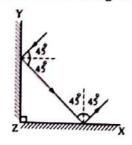
1. (a) 50°　　(b) **Answer by yourself.**

2. The value of the reflected angle = 40°
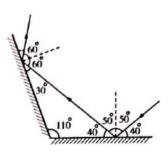
3. (a) Number (2).

(b) Angle of incidence = Angle of reflection.

4.

5.
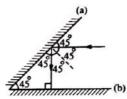
The angle of reflection from mirror (B) = 60°

6. (a) 60°　　　(b) 60°　　　(c) 120°

7.

– Angle of incidence on mirror (b) = zero
, Because the incident light ray from mirror (a) fall perpendicular on mirror (b).

8. (a) 60°　　　　(b) 0

9. Fig. (A) : Angle of reflection = zero.

Fig. (B) : Angle of reflection = 60°.

Fig. (C) : Angle of reflection = zero.
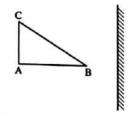
10. (a) Figure (1)
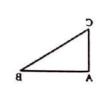
(b) The image is inverted - the distance of the image from the mirror not equal the distance of the object from the mirror.

11. (a) Shape (B).

(b) The image is upright, virtual, laterally inverted and equal to the object.

12. (a)

(b) The image is upright and laterally inverted.

13. – The distance between the pencil and mirror
$(d_1) = 3.5$ cm.

– The distance between mirror and the image of barrier $(d_2) = 1 + 3.5 = 4.5$ cm.

– The distance between the pencil and the image of barrier $(d) = d_1 + d_2 = 3.5 + 4.5 = 8$ cm.

14. (a) Convex mirror.　　(b) Concave mirror.
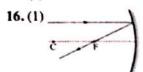
(c) The principal axis of the mirrors.

(d) The radius of concave mirror curvature.
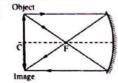
(e) The focal length of the convex mirror.

(f) The pole of the convex mirror (P).
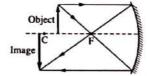
15. (a) incident light   (b) the focus of the mirror.
    (c) 10   (d) Concave mirror.
    (e) 10

16. (1)   (2)
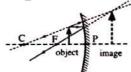
17. (1) – The image is at the centre of curvature.
     – The properties of the image :
     Real, inverted and equal
     to the object.

     (2) – The image is formed at a distance greater
        than the double of the focal length.
        – The properties
        of the image :
        Real – inverted –
        magnified.

18. (a) Radius of curvature of the mirror = 10 cm.
    (b) Focal length of the mirror = $\frac{1}{2}$ radius of
     curvature = $\frac{1}{2} \times 10 = 5$ cm.

19.
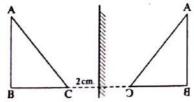
The properties of the formed image :
- Virtual.   - Upright (Erect).   - Magnified.

Answers of Timss

1 1. c   2. d   3. d   4. c

2

$\because (AC)^2 = (AB)^2 + (BC)^2$

$\therefore (BC)^2 = (AC)^2 - (AB)^2$

       $= 25 - 16$

       $= 9$

$\therefore (BC) = \sqrt{9} = 3$ cm.

, $\because$ The distance between the point (B) and the
     mirror $(d_1) = 3 + 2 = 5$ cm.
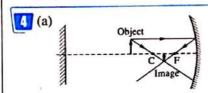
So, the distance between its formed image (B) and
the mirror $(d_2) = 5$ cm.

$\therefore$ The distance between the point (B) and its
formed image (B) = $d_1 + d_2$

               $= 5 + 5$

               $= 10$ cm.

2 Position (2), because the eye sees the object at the
extension of the reflected ray, and the distance of
the image from the mirror equals the distance of
the object from the mirror, also the straight line
connecting between the object and its image is
perpendicular to the surface of the mirror.

4 (a)

(b) The properties of the formed image in the
    concave mirror :

    real – inverted – diminished

Lesson 2

1

1. d	2. a	3. c	4. b	5. a	6. d
7. d	8. b	9. c	10. a	11. c	12. a
13. c	14. b	15. a	16. b	17. d	18. b
19. a	20. a	21. c	22. c	23. a	24. c
25. a	26. a	27. c	28. c	29. a	30. d
31. d	32. d	33. a	34. c	35. d	36. a
37. d	38. c	39. b	40. d	41. d	42. c
43. b	44. c	45. b	46. a	47. c	48. b
49. d					

2

1. refracts   2. The concave lens
3. convex.   4. convex
5. separates   6. diverges
7. two centres   8. principal axis.
9. optical centre   10. refraction.
11. the focus.   12. the distance
13. 100 cm   14. the focus
15. larger than
16. a distance smaller than the focal length.
17. 20 cm.   18. convex lens
19. virtual, erect.   20. 25 cm.
21. far   22. short-sightedness.
23. behind.   24. convex lens.
25. concave lens.   26. cornea
27. Cataract

25

3

1. The lens. 2. The concave lens.
3. The convex lens.
4. The optical centre of the lens.
5. The radius of curvature of the face of the lens (r).
6. The radius of curvature.
7. The principal axis of the lens.
8. The optical centre of the lens.
9. The secondary axis.
10. The real focus of the convex lens.
11. The focal length of the lens.
12. Real image. 13. The virtual focus.
14. The concave lens. 15. Short-sightedness.
16. Concave lens 17. Long-sightedness.
18. The concave lens. 19. The convex lens.
20. Contact lenses. 21. Transparent plastic.
22. Cataract.

4
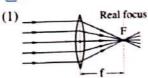
1. convex – concave 2. diverges
3. refracts – reflects 4. concave – convex
5. parallel – refraction
6. the optical centre of the lens.
7. the focus – the optical centre of the lens.
8. The radius of the lens curvature.
9. larger than. 10. double
11. 20 12. 5 cm.
13. without refraction. 14. passing through the focus.
15. 6 cm. 16. 15 cm.
17. a concave 18. inverted – magnified.
19. focus 20. parallel.
21. convex
22. virtual – erect – diminished.
23. diverge – in front. 24. concave – convex.
25. concave 26. Telescope – microscope
27. 25 cm – 6 m.
28. short-sightedness – long-sightedness.
29. long-sightedness – convex
30. short-sightedness – concave
31. long-sightedness. 32. concave
33. convex – concave
34. long-sightedness. 35. in front of – behind
36. convex
37. the medical glasses - transparent plastic
38. Old age – illness 39. exchange – transparent plastic
40. Land surveyors and topographical
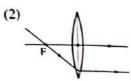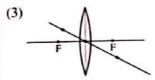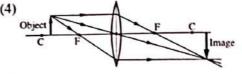
5

6
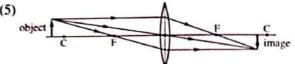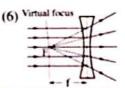
1. Because the convex lens collects light rays falling on it, while the concave lens separats light rays falling on it.
2. Because in the thick convex lens, the convexity of its face is large so, the focus is nearer to the optical centre (smaller ratius of curvature).
   while in the thin convex lens, the convexity of its face is small so, the focus is farther to the optical centre (larger radius of curvature).
3. Because it has two spherical surfaces, each surface has a centre.
4. Because the collective lens which is a convex lens has two spherical surfaces, but the collective mirror which is a concave mirror has one spherical surface.
5. Because when the object is placed at the focus of a convex lens the refracting ray doesn't meet and pass as a parallel way.
6. Because the convex lens can converge and concentrate sunlight in a point (focus) which leads to the burning of this paper.
7. Because the image formed by the concave lens is a virtual image formed as a result of the intersection of the extensions of the refracted rays. So, it cannot be received on the screen.

8. Because the virtual focus is formed from meeting of the intersection of the extensions of the diverging rays.
9. Because the eye lens is not always convex or the eyeball is not always spherical.
10. Because the images of these objects do not fall on the retina of the eye but in front of it.
11. Due to :
    – The increase in the eyeball diameter.
    – The increase in convexity of the eye lens surface.
12. Due to the increase in the eyeball diameter.
13. Because the concave lens diverges the rays coming from a far object , so the image is formed on the retina.
14. Due to :
    – The decrease of the eyeball diameter.
    – The decrease of convexity of eye lens surface.
15. Because the image of the close objects do not fall on the eye retina but behind it.
16. Due to the decrease of the eyeball diameter.
17. Due to the decrease of convexity of eye lens surface or the decrease of the eyeball diameter which lead to increase of the focal length, so the rays coming from the near object are converged in a point behind the eye retina.
18. Because the convex lens converges the rays, so the image of the object is formed on the retina.
19. Cataract is occurred due to some reasons such as : old age - illness - side effects of drugs - genetic readiness.

7

1. – It is a transparent medium that refracts the light and is limited with two spherical surfaces.
    – It is usually made of glass or transparent plastic.
2. – It is thin at its centre and more thick at the tips.
    – It separates light rays, so it is called diverging lens.
3. – It is thick at the centre and less thickness at the tips.
    – It collects light rays falling on it, so it is called converging lens.
4. It is a real focus formed by the collection of the refracted light rays.
5. It is the centre of the sphere, where this face is a part of it.
6. It is a point inside the lens that lies on the principal axis in the mid distance between its two faces.
7. It is the straight line that joins between the two centres of curvature of the lens passing by the optical centre of the lens.
8. It is the point of collection of the refracted rays or their extensions.

9. It is the distance between the principal focus of the lens and its optical centre.
10. It is a vision defect through which the near objects only can be seen clearly, but the far objects seem distorted.
11. It is a vision defect through which the far objects only can be seen clearly but the close objects seem distorted.
12. It is very thin lenses made of transparent plastic, and can stick to the eye cornea by the eye fluid.
13. It is a disease that causes a difficulty of vision as a result of the darkness of the eye lens.

8

1. The distance between the principal focus and the optical centre of the lens equals 15 cm.
2. This means that the focal length of this lens is 10 cm.
3. – Half the diameter of the sphere where this face is a part of it equals 20 cm.
    – The focal length of this lens = 10 cm.
4. This means that this lens is a convex lens.
5. This means that the image can't be received on a screen.
6. This means that the person sees the near objects only clearly, but the far objects seem distorted.
7. This means that the person sees the far objects only clearly, but the close objects seem distorted.

9

1. It is used to correct the long-sightedness.
2. It is used to correct the short-sightedness.
3. They are used instead of the glasses to correct the vision defects.
4. It used to from enlarged and near images for the celestial bodies.

10

1. When the object is put at the centre of curvature of a convex lens.
2. When the object is put in front of the concave lens.
3. When there is an increase in the eyeball diameter or an increase in the convexity of the eye lens surface.

11

1. The focal length also increases twice.
2. The rays after being refracted collect in one lit point is called the focus of the lens that can be received on the screen.
3. The piece of paper is burned.
4. It passes through the lens without refraction.
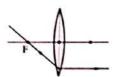
5. It refracts passing through the focus.

6. It exists from the lens parallel to the principal axis.

7. No image is formed.

8. A real, inverted and equal image will be formed at a distance equal to the double of the focal length on the other side of the lens.

9. You must put the object at a distance less than the focal length of the convex lens.

10. The parallel rays pass through the concave lens, then they are diverged and their extensions are collected in a virtual focus of the lens.

11. A virtual, erect and diminished image is formed nearer to the object position (according to the lens), and in its same side.

12. He can see near objects only clearly but far objects seem distorted, so he suffers from short-sightedness.

13. He can see far objects only clearly but close objects seem distorted, so he suffers from long-sightedness.

14. It causes short-sightedness.

15. It causes long-sightedness.

16. It is difficult to vision as a result of the darkness of the eye lens.

12

1.

2.

3.

4.

5.

Properties of the formed image : Virtual, erect and magnified.

6.
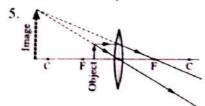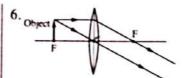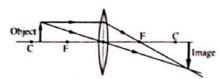
7.
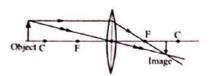
The properties of the formed image :
– Real.   – Inverted.   – Magnified

8.
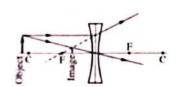
The properties of the image :
– Real.   – Inverted.   – Diminished

9.
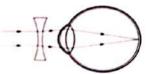
The properties of the image :
– Virtual   – Erect   – Diminished
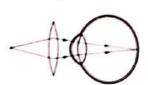
10.

By using a concave lens which diverges the far rays, so the image of the object is formed on the retina.

11.

13

The position of the formed image	The properties of the formed image
1. Between the focus and the centre of curvature.	1. Real, inverted and diminished.
2. At the centre of curvature.	2. Real, inverted and equal to the object.
3. After the centre of curvature.	3. Real, inverted and magnified.
4. Farther than the object position (according to the lens), and in its same side.	4. Virtual, erect and magnified.

14

1.

Lenses	Spherical mirrors
They are transparent media that refract the light and are limited with two spherical surfaces.	They are mirrors whose reflecting surface is a part of a hollow sphere.

2.

Convex lens	Concave mirror
• The position of the image : It is formed farther than the object position and in its same side. • The properties of the image : Virtual - erect - magnified.	• The position of the image : Behind the mirror. • The properties of the image : Virtual - erect - magnified.

3.

Convex lens	Concave lens
- It is a transparent optical piece which is thick at the centre and less thickness at the tips. - It collects light rays falling on it, so it is called converging lens.	- It is a transparent optical piece which is thin at the centre and more thick at the tips. - It separates light rays, so it is called diverging lens.

4. The focal length of the thick convex lens is small, the focal length of the thin convex lens is large.

5.

Principal axis of the mirror	Principal axis of the lens
It is the straight line that passes by the pole of the mirror and its centre of curvature.	It is the straight line that joins between the two centres of curvature of the lens passing by the optical centre of the lens.

6.

Properties of the image formed by a convex lens	Properties of the image formed by a concave lens
• Real. • Inverted. • Magnified.	• Virtual. • Erect. • Diminished.

7.

On a convex lens	On a concave lens
The refracted light rays collected in a point (real focus).	The extensions of the refracted light rays collected in a point (virtual focus).

8.
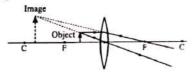
The principal focus of the concave mirror	The principal focus of the concave lens
• It is the point of collection of the reflected light rays. • It is real.	• It is the point of collection of the extensions of the refracted light rays. • It is virtual.

9. *Look at the main book on page (168).*
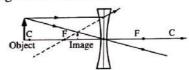
15 *Look at the main book on pages (158 & 159).*

16

1. By using a convex lens.
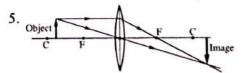
2. By using a concave lens.

17
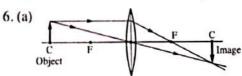
1. *Look at the main book on page (155).*
2. • The convex lens (converging).
   • The concave lens (diverging).
3. (a) It is used for formation enlarged and near images for the celestial bodies.
   (b) It is used in formation of magnified images for the tiny bodies which can not be seen with the naked eye.
   (c) They are used instead of the glasses to correct the vision defects.
4. • The distance of the formed image = 20 cm.
   • The properties of the image :
   – Real.   – Inverted.   – Equal to the object.
5.

The properties of the formed image :
   – Real.   – Inverted.   – Magnified.
6. (a)
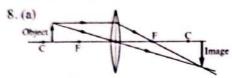
   (b) ∵ Diameter = 16 cm.
   ∴ Radius = 8 cm.

29
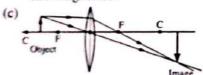
∴ The distance between the object and the image = 8 + 8 = 16 cm.

(c) The properties of the image :
Real, inverted and equal to the object.

7.
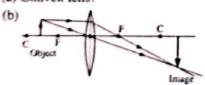
(a) The image is real, inverted and equal to the object.

(b) 4 cm.   (c) 6 cm.

(d) The image is formed at the centre of curvature.

8. (a)

(b) After the centre of curvature.

(c) Real, inverted and magnified.

(d) The radius of the lens = 8 cm.

9. (a) 9 cm.

(b) 5 cm. – 1 cm

(c) Real and inverted.

10. (a) Convex lens – 20 cm.

(b) - The position of the formed image after the position of the object in the same side.

- Properties of the formed image : Virtual, erect and magnefied.

(c)

11. (a) Convex lens.

(b)
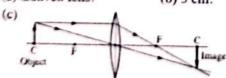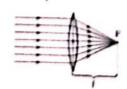
12. (a) Convex lens.   (b) 3 cm.

(c)

13.

14. • The reasons are :

- The increase in the eyeball diameter.

- The increase in convexity of the eye lens surface.
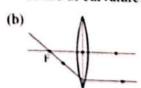
• Correction : By using a concave lens which separates the rays coming from a far object, so the image is formed on the retina.

15. • The reasons are :

- The decrease in the eyeball diameter.

- The decrease in convexity of the eye lens surface.

• Correction : By using a convex lens which collects the rays, so the image of the object is formed on the retina.

16. (a) Long-sightedness.

(b) By using a convex lens.

17. (a) It is a vision defect through which near objects only can be seen clearly but far objects seem distorted.

(b) Concave lenses.

18. (a) Correct.

(b) Because when the lens is near to eye (at a distance less than the focal length), all the images formed for objects are erect, while when the lens is far from the eye (at a distance greater than the focal length) all the images formed for objects are inverted.

19. (a) Concave lens.

(b) Concave mirror.

18

1. X : The principal axis.

Y : The optical centre of the lens.

Z : The focal length of the lens.

2. (a) Convex lens.   (b) 15 cm.   (c) 30 cm.

3. (a) The ray ③ because it falls passes through the optical centre of the lens.

(b) The ray ① because it is falling parallel to the principal axis.

(c) The ray ② because it falls passes through the focus of the lens.

4. (a) Figure number (3) because when a refracted ray parallel to the principal axis, it must fall passing through the focus not through the centre of curvature.
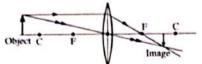
(b)

5.

• Position of the formed image : After the centre of curvature.
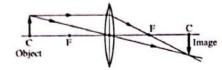
• Properties of the formed image :
– Real   – Inverted   – Magnified

6.

7. (a)
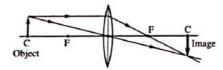
(b) Real, inverted and equal to the object.

8. (a)
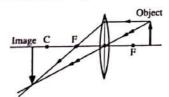
(b) At the centre of curvature.

9. (a) At the focus.

(b) Because the refracted rays from a lens don't meet and pass through a parallel way.

10. (a) ∵ The formed image by the lens is real, inverted and equal to the object.

∴ The object is at the centre of the lens curvature.

So, the focal length $= \dfrac{12}{2} = 6$ cm.

(b) ∵ This image is formed at the centre of the lens curvature, away from the plane mirror by 8 cm = (20 – 12) cm.

So, the distance between the object and the image formed by the plane mirror

$= 8 + 8 + 12 + 12 = 40$ cm.

– This image formed by the plane mirror is inverted for the object.

11.
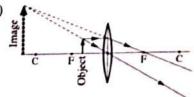
The properties of the formed image :
– Real.   – Inverted.   – Magnified.

12. (a)

The properties of the image :
– Virtual.   – Erect.   – Magnified.
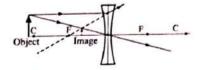
(b) No image is formed, where the rays refract as parallel so, their extensions cannot be intersected.

13. (a) Position 3

(b) Position 1

(c) Position 2

14.

• Position of the formed image :
The image is formed nearer to the object position (according to the lens), and in its same direction.

• Properties of the formed image :
– Virtual.   – Erect.   – Diminished.
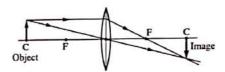
15. (a) 20 cm.

(b) Real, inverted and equal to the object.

16. (a)

(b) The distance between the two images formed by the lens and the mirror = 8 + 8 = 12 + 12 = 40 cm.

17. (a) 12 cm.   (b) 12 cm.   (c) 48 cm.

18. – The thin lens has greater focal length than the thick one.

– The reason :

Because in the thin lens, the convexity of its lens face is small so, the focus is farther to the optical centre. But, in case of the thick lens, the convexity of its lens face is large so, the focus is nearer to the optical centre.
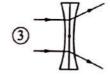
19. (a) Real, inverted and diminished.

(b) At position (3).

(c) (4)

20. The person who has the lens (A) suffers from short-sightedness as the increase in the convexity of the eye lens surface, where the image is formed in front of the retina.

21. (a) Short-sightedness.   (b) Concave lens.

22. (a) Long-sightedness.

(b) Convex lens.

(c) The eye sees the far objects only clearly but close objects seem distorted.

23. (a) Figure (a), because the refracted rays are collected on the retina.

(b) Figure (b), because this case is long-sightedness and the convex lens collects the rays, so the image of the object is formed on the retina.

24. (a) - Figure (a) : Long-sightedness.

- Figure (b) : Short-sightedness.

(b) - Figure (a) : The image is formed behind the retina.

- Figure (b) : The image is formed in front of the retina.

25. (a) ① : Concave mirror.

② : Convex lens.

③ : Concave lens.

④ : Plane mirror.

(b)

Answers of Timss

1 1. d   2. a   3. d   4. c
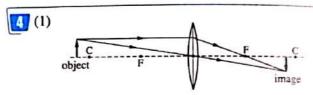
2 By falling the refracted light ray perpendicular on the plane mirror, so it reflects on itself and passes again through the optical centre of the convex lens without being refracted.

3 (1) Fig. (3), Because the eyeball diameter is suitable for formation of real images of objects on the retina.

(2) Fig. (1), Because the decrease in the eyeball diameter leads to long-sightedness which is corrected by a convex lens.

4 (1)

(2) Real, inverted and diminished.

(3) The length of the image becomes equal to the object (3 cm), and its distance from the lens becomes equal the double of its focal length (8 cm).

(4) Because the object in this case is at the focus, therefore the refracting rays from a lens don't meet and pass through a parallel way at infinity.

(5) Virtual, erect and magnified.

5 convex mirror – concave lens
concave mirror – convex lens

Project On UNIT Two *Answer by Yourself*

Unit Three

The Lesson

1

1. b	2. c	3. d	4. c	5. a	6. c
7. d	8. c	9. b	10. a	11. b	12. a
13. c	14. d	15. a	16. c	17. c	18. d
19. a	20. c	21. c	22. d	23. c	24. c
25. d	26. c	27. a	28. b	29. d	30. b
31. c	32. d	33. b	34. a	35. a	36. c
37. c	38. d	39. c	40. b	41. b	

2

(1) 1. g   2. c   3. e   4. a   5. d   6. f   7. b

(2) 1. c   2. a   3. b

3

1. (✗) The universe ....   2. (✓)
3. (✗) Stars .... centre of the galaxy.
4. (✓)   5. (✗) .... in galaxy.
6. (✓)   7. (✗) .... one star.
8. (✗) .... Sun.   9. (✗) Eight ....
10. (✗) .... hydrogen and helium.
11. (✓)   12. (✗) Universe ....
13. (✓)
14. (✗) .... after 3000 ....
15. (✓)
16. (✗) The Sun ....
17. (✗) The gravity of the Sun ....
18. (✗) .... the modern theory ....
19. (✗) .... the modern theory ....
20. (✓)
21. (✗) .... the nebula.
22. (✗) .... Fred Hoyle ....

4

1. stars   2. Milky Way
3. light year   4. centre
5. spiral   6. planets.
7. Sun   8. light year.
9. 220 million years
10. galaxy.
11. hydrogen and helium
12. 15000 million years.
13. Big Bang theory.
14. Nebular   15. nebula
16. Pierre Simon Laplace

---

17. itself.   18. Sun's gravity.
19. the Milky Way galaxy.
20. are Chamberlain and Moulton.
21. nuclear   22. Fred Hoyle.

5

1. The universe.   2. Galaxies.
3. Galaxies clusters.
4. The Milky Way galaxy.   5. The solar system.
6. Light year.
7. Expansion of the universe.
8. Big Bang theory.   9. The Sun.
10. The attraction force of the Sun.
11. Laplace.
12. Chamberlain and Moulton.
13. Nebula.   14. Nebular theory.
15. The crossing star theory.
16. The modern theory of the world.
17. Stars explosion phenomenon.
18. Solar telescopes.   19. Hubble telescope.

6

1. the universe.   2. Galaxies
3. harmony – order   4. galaxy.
5. Milky Way galaxy.
6. galaxy – 100 000 million galaxies.
7. clusters – Milky Way
8. centre – spiral   9. eight planets
10. 220   11. Light year
12. Milky Way   13. Big Bang.
14. gaseous – pressure – temperature
15. Sun
16. Milky Way galaxy – galaxy.
17. hydrogen – helium   18. 3000
19. disc – 5000   20. 25% – 75%
21. World order.   22. The Sun gravity.
23. decreases – slower.   24. nebula – Saturn
25. Laplace.   26. contracted – itself
27. Chamberlain – Moulton. 28. gaseous – Sun
29. Fred Hoyle.
30. Crossing star – modern 31. Fred Hoyle
32. cooling – contraction
33. Solar   34. Hubble

7

1. Because it appears in the sky at night as a splashing milk or spreading straw.

2. Because each galaxy has a distinctive shape according to the harmony and order of the groups of stars in it.

3. Because the distances between stars are very large.

4. Due to the movement of the galaxies apart.

5. As a result of their regular movement.

6. , 7. Due to the Sun gravity.

8. Due to the effect of the centrifugal force that is resulted from the rotation of the nebula around itself.

9. Due to occurrence of sudden and violent nuclear reactions.

10. Due to the explosion in the expanded part of the Sun that faces the huge star.

8

1. It is the wide and extended space that contains all the galaxies, stars, planets, moons, living organisms and everything.

2. They are the greatest units that form the universe. Or They are groups of stars that rotate together in cosmic space by the effect of gravity.

3. It is a spiral galaxy that contains millions of stars and the solar system is located in one of its spiral arms.

4. It is the distance covered by light in one year and it equals 9.46×10^{12} km.

5. It is the continuous separation between galaxies in space as a result of their regular movement.

6. It is a theory explains the origin of the universe from a massive explosion since 15000 million years and resulted in it all forms of matter, energy, time and space followed by continuous expansion and changing processes.

7. It is a glowing gaseous sphere revolving around itself, from which the solar system was originated.

9 *Answer by yourself.*

10

1. The universe is in a state of continuous expansion.

2. Galaxies are formed.

3. Formation of gaseous clouds of hydrogen and helium gases with a percentage of 75% : 25% respectively which produced the galaxies, stars and universe over millions of years.

4. The origin of the universe with all its forms of matter, energy, space and time.

34

5. Its size contracted and its revolving speed around itself increased.

6. The Sun escaped from the gravity of this huge star and a gaseous line was formed from the Sun until the last planets.

7. The bombing of the star's nucleus away from the gravity of the Sun and a gaseous cloud from this star remained around the Sun.

8. The star attracted the Sun to it which led to a great expansion in the part of the Sun facing it.

9. It contracts and forms planets.

11

1.

Universe	Galaxy
It is the wide and extended space that contains all the galaxies, stars, planets, moons, living organisms and everything.	It is a group of stars that rotate together in cosmic space by the effect of gravity.

2. *Look at the main book on page (195).*

3. *Answer by yourself.*

4. *Answer by yourself.*

5. *Look at the main book on pages (203 & 205).*

12 *Look at the main book on pages (197 & 198).*

13

1. The planets will leave their orbits and float in a random fashion in space and therefore there will be no solar system.

2. The gravity between them decreases and the movement of the planet around the Sun becomes slower.

3. The shape of galaxy is changed.

14

1. It is responsible for keeping the planets in their orbits around the Sun and the moons in their orbits around the planets.

2. A unit used to measure the distances between celestial bodies (stars).

3. It forms the planets.

4. It forms a complete picture of the Sun.

5. It collects photos for the universe that give us details about its state since millions of years, these photos give astronomers an opportunity to study the evolution of the universe after the Big Bang.

15 *Answer by yourself.*

16

1. (a) • Hydrogen : 75%
      • Helium : 25%
   (b) 10 000 million degrees.
2. (a) World order.
   (b) • There is something that looks like clouds or nebula in the space.
      • The space contains many cloudy rings surrounding some planets such as the rings of Saturn planet.
   (c) *Look at the main book on page (202).*
3. *Look at the main book on page (203).*
4. *Look at the main book on pages (204 & 205).*
5. (a) 15 000 million years.
   (b) 100 000 million galaxies.

17

1. Matter got joined in masses.
2. Ancestral galaxies were originated.
3. The Sun was born and the Earth and the planets were created.
4. Earliest life forms began to appear on the Earth.

18

1. (a) The Milky Way galaxy.
   (b) (X) : The centre of the galaxy.
      (Y) : Spiral arms of the galaxy.
      (Z) : The Sun.
   (c) The old stars gather in the centre of the galaxy and surrounded by the recent stars are located in spiral arms of the galaxy.
   (d) The Sun takes about 220 million years to complete one rotation around the centre of the galaxy.
2. (a) (1) Expansion of the universe.
      (2) The separation of the grains of raisins resembles the separation of the galaxies from each other in the universe.
   (b) The universe is in a state of continuous expansion.
3. (a) Big Bang.
   (b) The universe matter was a gaseous ball of high pressure, high temperature and small in volume.
   (c) About 10 000 million years.
4. (a) Nebular theory.
   (b) The nebula, originated from a glowing gaseous sphere revolving around itself.

(c) The centrifugal force which is resulted from the rotation of nebula around itself.
(d) It represents the formation of the solar system.
(e) (X) : The Sun is formed from the flaming mass that is remained from the nebula in the centre.
   (Y) : The planets of the solar system are formed from the gaseous rings that are separated from nebula after cooling and frozen.

5. (a) The crossing star theory.
   (b) (1) The Sun.
      (2) The expanded part from the Sun.
      (3) A crossing star.
   (c) number (1).
   (d) This led to the Sun escaped from the gravity of this star and a gaseous line was formed of a great length from the Sun until the last planets.
   (e) They are formed when the gaseous line started to condense due to the attraction force, then it cooled forming the planets.

6. (a) (1) Rotation of another star nearer to the Sun.
      (2) Explosion of the other star as a result of sudden nuclear reactions within it.
      (3) Bombing of the other star's nucleus away from the gravity of the Sun.
      (4) Rotation the remaining gaseous cloud from the other star around the Sun.
   (b) – It points to the gaseous cloud.
      – It is subjected to cooling and contraction processes forming the matter of planets.

Answers of Timss

1

1. The Earth / Solar system / Milky Way galaxy / Universe.
2. Big Bang / Formation of hydrogen and helium gases / Galaxies began to form / Birth of the Sun / Earliest life forms began to appear.

2 Because there is a constant orbit for each planet.

Project On UNIT Three *Answer by Yourself*

Unit Four

Lesson 1

1

1. b	2. c	3. a	4. b	5. c	6. c
7. b	8. b	9. b	10. a	11. a	12. d
13. c	14. a	15. a	16. d	17. a	18. a
19. b	20. d	21. a	22. c	23. b	24. a
25. a	26. a	27. b	28. d	29. c	30. b
31. d	32. d	33. c	34. d	35. c	36. d
37. d	38. b	39. d			

2

(1) 1. c   2. c   3. b   4. d
(2) 1. d   2. c   3. a   4. b
(3) 1. b   2. c   3. a

3

1. (✗) .... in the nucleus of the cell.
2. (✗) .... are thread like bodies.
3. (✗) .... at the centromere.   4. (✓)
5. (✗) .... DNA and ....
6. (✗) .... is diploid.
7. (✗) .... equal double its number ....
8. (✗) .... haploid ....
9. (✗) Centromere is ....
10. (✗) .... by mitosis ....   11. (✓)
12. (✗) .... in the interphase.
13. (✗) .... prophase ....
14. (✗) .... in the animal cell ....
15. (✗) .... in prophase.
16. (✗) .... are formed during the prophase and disappear in the telophase.
17. (✗) In the plant cell, ...
18. (✗) In metaphase ....
19. .... in metaphase.
20. (✗) .... in anaphase.
21. (✗) .... , (2).
22. (✗) .... in reproductive cells.
23. (✗) .... four cells ....
24. (✗) .... known as the reproductive cells ....

25. (✗) .... by meiosis ....   26. (✓)
27. (✗) .... leads to the formation of gametes.
28. (✓)   29. (✓)
30. .... double of ....
31. (✗) .... prophase of ....

4

1. Chromosomes.   2. Cell nucleus.
3. Chromosome.   4. Centromere.
5. DNA.   6. Cell division.
7. Mitosis.   8. Interphase.
9. Prophase.   10. Spindle fibers.
11. Spindle fibers.   12. Metaphase.
13. Telophase.   14. Meiosis.
15. Reproductive cells   16. Gametes.
17. Tetrad.
18. Crossing over phenomenon.
19. Cancer.   20. Tumor.

5

1. Somatic cells – reproductive cells
2. nucleus – chromosomes.
3. nucleic acid – DNA – protein. 4. DNA – genes
5. two chromatids – centromere.
6. fixed – different   7. haploid – diploid
8. mitotic cell division – meiotic cell division.
9. Meiotic.   10. Mitotic.
11. interphase.
12. chromatin reticulum – chromosomes
13. nucleolus – nuclear membrane
14. the centrosome – condensing the cytoplasm
15. metaphase   16. prophase – telophase
17. centromere – chromatids 18. telophase.
19. telophase   20. Meiotic
21. sperms – ova.   22. testes – ovaries.
23. pollen grains.
24. pollen grains – eggs. 25. half.
26. first meiotic division – second meiotic division.
27. anther – ovary.   28. 8
29. homologous – 4 – a tetrad.
30. half – reduction   31. meiotic – mitotic
32. 22 – 22
33. crossing over.
34. prophase I – meiotic
35. The two homologous chromosomes.
36. Crossing over phenomenon.
37. Nano-technology.   38. gold – laser
39. liver transplantation.

[6]

1. Because it consists of nucleic acid (DNA) that carries the genes which carry the genetic traits of the living organism.
2. To prepare the cell for division through some important biological processes, where the amount of genetic material duplicates.
3. To make each of the resulted cells from division has a complete copy of genetic material.
4. Because somatic cell divided by mitosis, while reproductive cell divided by meiosis.
5. Because in the plant cell, the spindle fibers are formed from condensing the cytoplasm at the cell's poles, while in the animal cell, they are formed by the centromere.
6. To form two identical groups of chromosomes.
7. Because the changes that occur in telophase are adverse to that occur in prophase.
8. Because nerve cells doesn't contain centrosome.
9. Because the the cells of remaining part of his liver can divided mitoticaly and compensat the donated part.
10. Because the produced cells contain half the number of chromosomes of the original cell.
11. Because gametes produced by meiotic division, while somatic cells produced by mitotic division.
12. Due to the occurrence of the crossing over phenomenon during it.
13. Because it contributes in genes exchanging between the two homologous chromosome's (two internal chromatids) and distributing them randomly in the gametes.
14. Because mitotic division plays an important role in growth which the body of children needs, while meiotic division aims to the production of gametes only.
15. Because it helps in cell division as it forms spindle fibres.
16. Because in Nano-technology, very small molecules of gold metal are used which their lengths are measured by nanometre unit.
17. Because the Nano-molecules of gold metal which stuck to the surface of cancerous cell absorb the light energy of laser and convert it into heat energy which leads to burn and kill the infected cell.

18. Because this special protein can be loaded with Nano-molecules of gold, and also can be attached on the cancerous cell secretions.

[7]

1. They are thread like bodies found inside the cell nucleus and they represent the genetic material of the living organism.
2. It is the nucleic acid that forms chromosomes.
3. It is the point of connection between the two chromatids of chromosomes.
4. It is a process through which the living cell divides into two cells or more and aims to the growth or reproduction.
5. It is a network of filamentous fibers extending between the two poles of the cell, where each chromosome is connected with it by the centromere.
6. A kind of cell division that occurs in the somatic cells and aims to the growth of living organisms and compensating the damaged cells.
7. They are all body cells except the reproductive cells, they divide by mitotic division and contain a diploid number of chromosomes.
8. It is the phase in which, the cell prepares for division through some important biological processes and the amount of genetic material duplicates.
9. A kind of cell division that occurs in reproductive cells and aims to the formation of gametes.
10. That means as a result of Meiosis division, the number of chromosomes reduced to its half number in gametes.
11. It is a phenomenon that takes place at the end of prophase I and in which some parts of the two inner chromatids of each tetrad are exchanged to produce new genetic arrangement.
12. They are the arrangment of homobgous pairs of chromosomes, where each pair consists of 4 chromatids.

[8]

1. • They represent the genetic material of the living organism.
   • They have the main role in cell division.
   • Knowing the number of chromosomes helps in identifying the animal and plant species.
2. It is the point of connection of two chromatids of the chromosome.

3. It carries the genes and forms chromosomes that present in the cell nucleus.

4. • The growth of living organisms.
   • Compensation of the damaged cells.
   • Completing the asexual reproduction process.

5. They pull the chromatids to one of the cell poles in anaphase to form two identical groups of chromosomes.

6. It forms the spindle fibers.

7. Production of male gametes and female gametes to complete the sexual reproduction.

8. It produces pollen grains (male gametes).

9. It is responsible for the variation of genetic traits among the members of the same species.

10. Treating of cancer.

11. Attach (adhere) to the cancerous cell to monitor it.

12. Burning and killing the infected cell.

9

1. & 2. The cell division doesn't occur.

3. The spindle fibers are not formed therefore the cell division doesn't completed.

4. Crossing over phenomenon occur then the variation of genetic traits among the members of the same species will take place.

5. The gametes are not formed.

6. No variation of genetic traits among the members of the same species takes place.

7. The remaining cells undergo many mitotic divisions to compensate the missing part.

8. By passing time, the liver of each of them is completed as a result of mitotic divisions.

9. The golden Nano-particles absorb the light energy and convert it into heat energy, which burns and kills the infected cancer cells.

10

1. Two cells are produced contain the same number of chromosomes of the parent cell (2N).

2. & 3. Crossing over phenomenon occurs.

4. Reproductive cells will produce gametes that contain half number of chromosomes.

5. Leads to the formation of pollen grains and ova, where both of them have a haploid number of chromosomes.

6. The genetic variation occurs among the members of the same species.

11

1. *Answer by yourself.*

2.

Point of comparison	Somatic cells	Gametes
No. of chromosomes :	Diploid number (2N). i.e. : They contain the total number of chromosomes.	Haploid number (N). i.e. : They contain half the number of chromosomes.

3. *Look at the main book on page (239)*

4. Male gamete : sperm.
   Female gamete : ovum.

5. – Anther in the flowering plants : produces a gamete which is called pollen grain (male gamete).
   – Ovary in human body : Produces a gamete which is called ovum (female gamete).

6.

Prophase in mitosis	Prophase (I) in meiosis
In this phase : – Chromatin reticulum condenses, then appears in the form of long, thin and double strings (chromosomes). **At the end of this phase :** – The nucleolus and nuclear membrane disappear. – A network of filamentous fibers called a spindle is formed extending between the two poles of the cell. – Each chromosome is connected with one of the spindle fibers by the centromere.	**In this phase :** – Chromatin reticulum condenses and appears in the form of distinct chromosomes. – Each chromosome consists of two chromatids linked together by the centromere. – Chromosomes are arranged in homologous pairs, each pair consists of 4 chromatids which are called a tetrad. **At the end of this phase :** – Crossing over phenomenon occurs. – Nuclear membrane and nucleolus disappear. – Each two homologous chromosomes (in the tetrad) move away from each other. – The spindle fibers appear and connect to the chromosomes at centromere.

7.

Metaphase in mitosis	Metaphase I in meiosis
In this phase : Chromosomes which are connected with the spindle fibers are arranged along the cell equator.	**In this phase :** Chromosomes pairs (tetrad) arrange at the cell equator.

8.

Metaphase in first meiotic division [Metaphase I]	Metaphase in second meiotic division [Metaphase II]

9.

Anaphase in mitosis	Anaphase I in meiosis
In this phase : – The centromere of each chromosome, splits lengthwise into two halves, so the chromatids separate from each other. – Spindle fibers begin shrink and two identical groups of chromosomes are formed. – Each group of chromosomes migrate towards one of the cell's poles.	**In this phase :** – The spindle fibers shrink, so every two homologous chromosomes move away from each other. – One of the two chromosomes migrates towards a cell pole and the other migrates towards the other pole. – Therefore, each pole contains half the number of chromosomes of the parent cell.

10. *Answer by yourself.*

12

1. • **Centrosome :** It forms the spindle fibers in the animal cell.

   • **Centromere :** It is the point of connection of the two chromatids of chromosome.

2. • **The anther in plant :** It produces the pollen grains (male gametes).

• **The testis in animal :** It produces sperms (male gametes).

13

1. *Look at the main book on page (229).*

2. *Look at the main book on page (232).*

3. , 4. , 5. *Look at the main book on page (233).*

6. , 7. , 8. *Look at the main book on page (236).*

9. *Look at the main book on page (238).*

10. *Answer by yourself.*

14

1. *Look at the main book on page (229).*

2. 4 cells – (N) chromosomes.

3. a. – The division in the cell of uterus or the stomach is mitotic division and it aims to the growth of them or to compensate the damaged cells.

   – The division in the cell of ovary is meiotic division and it aims to form female gametes.

   b. – In mitosis : Two cells are produced which contain the same number of chromosomes of the parent cell.

   – In meiosis : Four cells which contain half the number of chromosomes of the parent cell.

   c. The metaphase in the uterus cell or in the stomach cell is shown in the opposite figure :

   Metaphase

4. a. – Plant stem cells divided by mitosis.

   – Plant ovary cells divided by meiosis.

   b. – The resulted cell of mitosis contains 6 pairs of chromosomes and that resulted of meiosis contains 6 chromosomes.

5. a. Prophase ⟶ Metaphase ⟶ Anaphase ⟶ Telophase

   b. The type of division is the mitotic division.

6. a. Metaphase.

   b. Interphase.

7. a. – Mitosis occurs in somatic cells (all cells of the plant except reproductive cells).

   – Meiosis occurs in reproductive cells (anther or ovary).

39

b. – **The importance of mitosis :**

It plays an important role in :

- The growth of living organism.
- Compensation of the damaged cells.
- Completing the asexual reproduction process.

– **The importance of meiosis :** Formation of male and female gametes.

8. 32 chromosomes.

9. a. 32 chromosomes.   b. 32 chromosomes.

   c. 16 chromosomes.

10. a. 23 pairs of chromosomes.

   b. 23 chromosomes.

   c. 23 pairs of chromosomes.

11. a. 40 chromosomes.   b. 20 chromosomes.

   c. 40 chromosomes.

12. a. 22 chromosomes.

   b. 22 pairs of chromosomes.

13. d

14. *Look at the main book page (236).*

15. *Answer by yourself.*

16. a. Anaphase.

   b. prophase.

17. • The liver cells are not divided in normal conditions but they retain the ability to divide under certain circumstances.

   • For example, if the liver gets injured or a part of it is cut, remaining cells undergo many mitotic divisions to compensate the missing part.

18. – The Egyptian scientist Dr. Mustafa El Said.

   – *Look at the main book on page (240).*

15

1. a. Chromatid.   b. Centromere.

   c. *Answer by yourself.*

2. a. Interphase before the cell division.

   b. **It prepares the cell for division by :**
   - The occurrence of some important biological processes.
   - The duplicate of the genetic material (DNA).

3. a. Mitotic division.

   b. Metaphase.

   c. 1. Compensation of the damaged cells.

   2. Completing the asexual reproduction.

   3. Growth the living organisms.

4. a. Prophase.

   b. Anaphase.

   c. Telophase.

   d. It prepares the cell for division by :
   - The occurrence of some important biological processes.
   - The duplicate of the genetic material (DNA).

5. a. (A) Anaphase. (B) Metaphase.

   b. In metaphase chromosomes are arranged along the cell equator, while in anaphase the chromatids separate from each other.

   c. **In this phase :**
   - The centromere of each chromosome splits lengthwise into two halves, so the chromatids separate from each other.
   - Spindle fibers begin to shrink and two identical groups of chromosomes are formed.
   - Each group of chromosomes migrate towards one of the cell's poles.

   d. (1) Centrosome.   (2) Spindle fibers.

   (3) Chromosome.

6. a. Metaphase.   b. Mitotic division.

   c. By centrosome, the spindle fibers are formed.

   d. During anaphase, the centromere of each chromosome splits lengthwise into two halves, so the two chromatids separate from each other.

   e. Somatic cells.

7. a. Metaphase.

   b. The spindle fibers are not formed.

   c. The following phase of the metaphase is the anaphase which has the following diagram :

8. a. Metaphase I.

   b. Crossing over phenomenon.

   Its importance :

   It works on the variation of genetic traits among the members of the same species, where it contributes in genes exchange between the two homologous chromosomes' (chromatids) and distributing them randomly in the gametes.

c. The next phase to the metaphase 1 is the anaphase I which has the following diagrams :

9. a. (1) Centrosome.   (2) Spindle fibers.

b. Anaphase I – first meiosis.

10. (1) Telophase.   (2) Metaphase.

(3) Prophase.   (4) Anaphase.

11. a. Metaphase.

b. The spindle fibers are formed by the centrosome.

c. Number. (2)

d. The centromeres are not split in this phase.

12. a. Metaphase I.

b. *Look at the main book on page (236).*

13. a. (1) Metaphase I.   (2) Prophase I.

(3) Telophase I.   (4) Anaphase I.

b. (2) ⟶ (1) ⟶ (4) ⟶ (3)

14. a. Mitotic cell division.

b. Number (2) : Prophase   Number (3) : Anaphase.

c. The nucleolus and nuclear membrane will disappear.

15. a. Case (1) : Mitosis – It occurs in somatic cells.

Case (2) : Meiosis – It occurs in reproductive cells.

b. *Answer by yourself.*

c. Ⓐ The testis and the ovary.

Ⓑ The anther and the ovary.

d. 10 chromosomes.

e. first meiotic – second meiotic.

16. *Answer by yourself.*

Answers of Timss

1

1. c   2. d   3. d   4. a   5. d

2

1. Shape number (2) as there is no cell division produce 3 cells.

2. In figure (1) : mitotic cell division.

- In figure (3) : meiotic cell division.

3. a. (3)   b. (1)   c. (3)   d. (3)

3

1. Mitosis.   2. Somatic cell.

3. No, because each resultant cell from mitosis have the same number of chromosomes presents in the parental cell.

4. No, because the resultant cells from mitosis are identical to the parental cell.

4

Figure (c), because the crossing over phenomenon occurs between the two internal chromatids of the two homologus chromosomes.

5 Mitotic division.

6

– In metaphase of mitotic division, 46 chromosomes arranged along the cell equator.

– In metaphase of second meiotic division, 23 chromosomes arranged along the cell equator.

Lesson 2

1

1. a	2. b	3. c	4. d	5. a	6. b
7. a	8. a	9. c	10. a	11. c	12. b
13. d	14. a	15. d	16. b	17. a	18. b
19. d	20. b	21. a	22. a	23. a	24. a
25. c	26. b	27. d	28. d	29. b	30. b
31. b	32. b	33. b	34. d	35. c	

2

(1) 1. d – B   2. c – C   3. a – A

(2) 1. d – A   2. c – C   3. b – B

3

1. (✗) Reproduction ....

2. (✗) .... asexual and sexual.   3. (✓)

4. (✓)   5. (✓)

6. (✗) Asexual ....   7. (✓)

8. (✗) .... divides mitotically ....

9. (✓)

10. (✗) .... budding.   11. (✓)

12. (✓)

13. (✗) .... from sexual reproduction ....

14. (✗) The gametes are often (N), while somatic cells are often (2N).

15. (✗) .... meiosis.

4

1. binary fission.   2. Yeast

3. budding.
4. regeneration.   5. mitotic
6. binary fission   7. bread mould fungus.
8. binary fission   9. yeast fungus.
10. binary fission.   11. Sexual.
12. gametes formation.   13. gametes.
14. mushroom.
15. vegetative reproduction.   16. gamete
17. the half   18. zygote.
19. Fertilization.   20. zygote.
21. zygote.

5

1. Reproduction process.
2. Asexual reproduction.
3. Reproduction by binary fission.
4. Reproduction by budding.   5. Bud.
6. Regeneration.
7. Reproduction by regeneration.
8. Starfish.   9. Sporongia.
10. Sporongia.
11. Budding.   12. Sporogony.
13. Vegetative propagation.
14. Asexual reproduction.
15. Sexual reproduction.   16. Fertilization process.
17. Gametes.   18. Reproductive cells.
19. Zygote.

6

1. reproduction   2. Reproduction – kind
3. asexual – sexual.   4. Asexual
5. Asexual – multicellular
6. gametes formation – fertilization.
7. Asexual.
8. reproduction by regeneration – spore propagation
   – budding
9. binary fission.   10. budding.
11. Hydra.   12. mitotic – two
13. amoeba.   14. one – two
15. budding – binary fission   16. parent cell – bud.
17. colony   18. genetic traits
19. asexual   20. starfish.
21. regeneration.   22. spore propagation.
23. Regeneration   24. spore propagation.
25. (2N).   26. bread mould – spores
27. vegetative organs – seeds.   28. anthers – ovaries.
29. sexual   30. half

31. Fertilization.
32. male gamete – female gamete.
33. mitotic – two parents.   34. zygote – complete

7

(a) Sexual   (b) Asexual
(c) Gametes formation   (d) Binary fission
(e) Reproduction by regeneration
(f) Spore propagation

8

1. Because by reproduction, the living organisms produce new individuals of the same kind.
2. Because asexual reproduction includes mitotic division only.
3. Because asexual reproduction occurs by mitotic division only through one individual.
4. Because it occurs through one parental individual by a mitotic division as the new individual gets a genetic copy identical to the parent.
5. Because the produced individuals obtains a complete copy of genetic traits of the parent individual.
6. Because two identical cells are produced, each contains a complete copy of the parent genetic material.
7. To make each cell from the resulted two cells gets genetic material identical to the original cell.
8. Because it splits into two identical cells.
9. Because the buds remain connected to the parental cell.
10. Because it can compensate the missing part by regeneration.
11. Because each lost arm can be reproduces by regeneration and give out a complete animal if it contains a part of the central disc of the animal.
12. Because regeneration is asexual reproduction that occurs by mitotic division.
13. Because it occurs without the need of seeds but by the plants' vegetative organs.
14. Because it is a vegetative reproduction occurs by the plants' organs (leaves, roots and stems).
15. Because the vegetative reproduction occurs through mitotic division, in which the new offspring obtains a complete copy of the parent genetic material.
16. Because it occurs by only one parent by mitotic division, where the produced individuals have the same genetic traits.
17. To release the spores present in sporangium, and to fall on a suitable environment.

18. Because by meiotic division, the gametes are formed which required to complete the sexual reproduction.

19. Because it is produced from the combination of a male gamete and female gamete, each of them contains half number of chromosomes of the parental organisms.

20. Because each of male gamete and female gamete contains half number of chromosomes (N), by combination, a zygote is formed which containing the whole number of chromosomes (2N).

21. Due to the occurrence of the crossing over phenomenon during the formation of gametes through the meiotic division and also the offspring resulting from sexual reproduction combines the genetic traits from two sources.

9

1. It is a biological process, where the living organism produces new individuals of the same kind and thus, ensuring its continuity.

2. It is a process in which living organisms produce new individuals with genetic traits identical to those of their parent.

3. It is asexual reproduction, where each parental cell divides mitotically then splits into two identical cells.

4. It is asexual reproduction produces new individuals by the formation of buds in the parent cell.

5. It is a type of asexual reproduction that occurs in some fungi and algae by producing spores.

6. It is the ability of animals to compensate their missing parts.

7. The ability of the missing part in some living organisms to grow forming a complete organism, if it contains a part of the central disc.

8. It is an asexual reproduction by using vegetative organs without the need of seeds.

9. A process in which living organisms produce new individuals with genetic traits different from those of their parents.

10. It is the combination of a male gamete and a female gamete to form a zygote which contains the complete number of chromosomes of the organism.

11. It is the fertilization process.

12. It is a cell produced due to fertilization and it contains the complete number of chromosomes of the living organism.

10

1. It produces new individuals of the same kind and preserves it from extinction.

2. The new offspring gets full copy of the parental individual genetic traits, so there are no genetic changes.

3. When a starfish losses one of its arms contains a part of the central disc. This part can grow forming a complete animal.

4. It keeps the spores until the completion of maturity.

5. Producing new individuals identical to the parental individual without the need of seeds.

6. The resulted offspring have new genetic traits different from parent's traits, so it is a source of genetic variation.

7. It forms the zygote which contains the complete number of chromosomes of the organism.

8. It grows forming a new offspring with traits of both parents.

11

1. Amoeba.　　2. Yeast fungus.　　3. Starfish.
4. Bread mould fungus.　　5. Human.

12

1.

Points of comparison	Asexual reproduction	Sexual reproduction
Number of parents :	One parent.	Two parents.
The genetic traits :	The new offspring get a full copy of the parent individual genetic traits.	The new offspring combines the genetic traits from two sources (the male and female).
The type of cell division :	Mitosis.	Meiosis.

2.

Points of comparison	Reproduction by budding	Reproduction by regeneration
Definition :	A type of asexual reproduction produces new individuals by formation of buds in the parent cell.	The ability of the missing part in some living organisms to reproduce forming a complete organism if it contains a part of the central disc.
Examples :	– Unicellular organisms (as yeast fungus). – Multicellular organisms (as hydra – sponge).	Starfish.

43

3., 4, 5. *Answer by yourself.*

6.

Gametes	Zygote
They are produced by special cells known as reproductive cells and contain half number of chromosomes.	It is produced due to fertilization and it contains a complete number of chromosomes of the organism.

13

1., 2., 3., 4. *Answer by yourself.*

5.

Spore	Pollen grain
It carries the complete number of genetic material.	It carries half the number of genetic material.

6.

Ovum	Fertilized ovum
It contains half the number of chromosomes (N).	It contains a complete number of chromosomes (2N).

7.

Spore	Zygote
– It is resulted from some algae and fungi.	– It is produced from combination of a male gamete (N) and a female gamete (N).
– It grows forming a new individual with genetic traits identical to the parent individual.	– It grows forming a new offspring with traits different from that of its parents.

14

1. The parental cell disappears and eight identical cells are produced.
2. The yeast fungus reproduces asexually by budding forming a new fungus separated from the parent cell or it remains cornnected to the parent cell forming a colony.
3. A new fungus is formed.
4. The starfish compensates its lost arm and the missing arm grows forming a complete animal.
5. They grow forming a new organisms (fungi).
6. A large number of spores are released.
7. No pollen grains are formed, and this plant can not reproduce sexually.
8. It grows forming a new plant.
9. A zygote which contains genetic material from both parents will be produced and when it grows, it gives a new offspring with traits of its parents.
10. The zygote will not be formed.

44

11. This living organism will not produce new individuals of the same kind which causes the extinction of this living organism.

15

1., 2., 3. The cells resulted are identical to the parental cell. Because they are produced by mitotic division.

4. The offspring resulted from germination of seeds has new genetic traits that combines the parent's traits because it is resulted through sexual reproduction.

16 1. • Binary fission.   • Budding.
   2. a. *Look at the main book on page (264).*
      b. *Look at the main book on page (262).*
   3. *Look at the main book on page (265).*
   4. *Look at the main book on page (268).*
   5. The two processes are gametes formation and fertilization process.
   6. *Look at the main book on pages (267 & 268).*

17

1. a. Budding, asexual reproduction.
   b. To give new individuals identical to the parent unicellular organism.
2. a. Reproduction by binary fission.
   b. Mitosis.
   c. Step (1) represents the genetic material of the bacteria.
      In step (2) the genetic material is doubled.
   d. The two cells in step (4) are identical to the cell in step (1).
3. a. (2) – (3) – (1) – (4) – Binary fission.
   b. (4) – (2) – (3) – (1) – Budding.
4. a. Starfish.
   b. Reproduction by regeneration.
   c. (1) arms-the central disc
      (2) (2N)
      Because regeneration is asexual reproduction that occurs by mitosis.
5. a. Spore propagation – Mitotic division.
   b. Sporangium – It keeps large number of spores till it becomes mature.
   c. Spores – They are released when the wall of sporangium is ruptured.
   d. When spores are scattered in a suitable environment, they grow to give new organisms.

e. The produced individuals are identical to the original bread fungus, because spore propagation is asexual reproduction that occurs by mitotic division.

6. a. Fig. (A) : Bread mould fungus.
   Fig. (B) : Starfish.
   b. Fig. (A) : It reproduces by spore propagation.
   Fig. (B) : It reproduces by regeneration.

7. a. In fig. (A) : Pollen grains.
   In fig. (B) : Spores.
   b. In fig. (A) : Sexual reproduction.
   In fig. (B) : Asexual reproduction.
   c. Meiotic division.
   d. In fig. (A) : The pollen grains contain half number of genetic material.
   In fig. (B) : The spores contain the complete number of genetic material.

8. a. Vegetative reproduction.   b. Tuber.
   c. Mitotic division.
   d. The produced cells have the same number of chromosomes of mother's cell.

9. a. – Fig. (1) is a colony which is formed as a result of the reproduction of the yeast fungus by budding.
   – Fig. (2) represents the sperms which surround the ovum before fertilization process.
   b. – At fig. (2).
   – As the type of reproduction in this figure is sexual reproduction which is considered as the source of genetic variation as the resulted offspring has new genetic traits that combine the parents' traits.

10. a. Fertilization process – Zygote.
    b. • Number (2) : Meiotic division.
       • Number (4) : Mitotic division.
    c. (1) and (2) : N   (3) : 2N

11. a. Sperms surround the ovum before fertilization.
    b. (N).   c. Zygote – (2N).
    d. The zygote has new genetic traits that combine both its parents' traits.

Answers of Timss

1 1. b   2. a   3. d   4. d   5. c

2
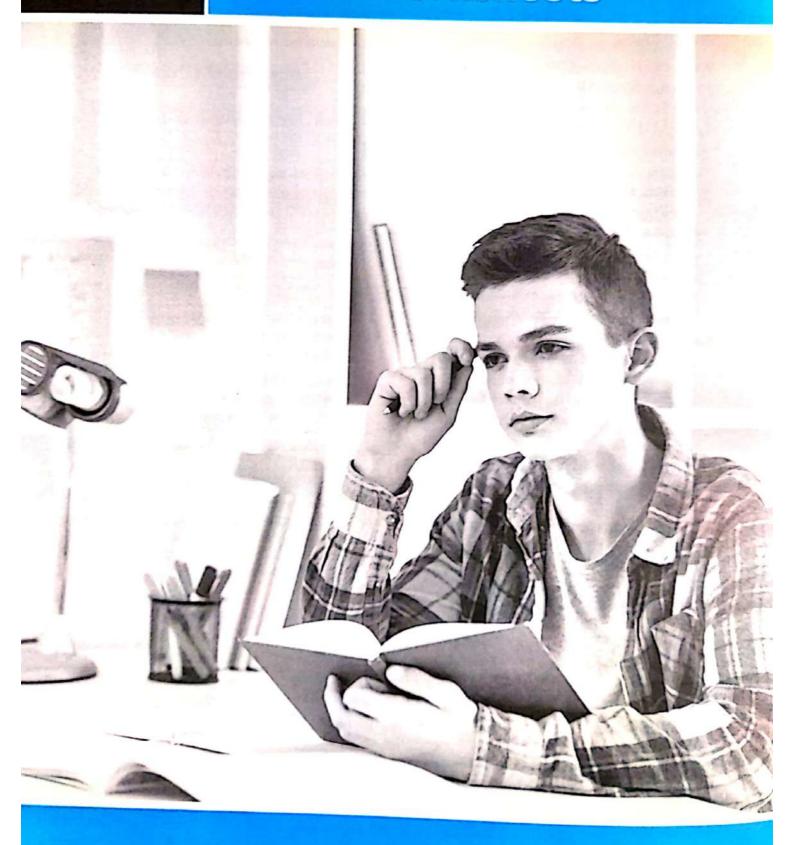
Sexual reproduction, to obtain new genetic traits. while vegetative reproduction, to maintain the good gentic traits and ensure their continuity.

3 Asexual reproduction which is a reproduction by budding.

4

1. In case (A) : Asexual (1 parent only).
   In case (B) : Sexual (2 parents).
2. In case (A) : Identical genetic structure between them (due to mitosis).
   In case (B) : Variation in genetic structure between them (due to meiosis).

5 2 complete starfish

6 The parent orgnism disappear in : amoeba, paramecium and euglena. and still present in the remaining other organisms.

Project on UNIT Four *Answer by Yourself*

45

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Unit One

Worksheet ❶

1

(A) 1. c   2. d   3. b

(B) 1. Light.   2. Motion.

2

(A) 1. Speed   2. Speed – Time.
3. 2   4. Speed

(B) 1. This means that the speed of the car equals 50 km/h.
2. This means that the train covers a distance of 70 km each one hour.
3. This means that the body moves at a regular speed equals 2 m/sec.
4. This means that the body covers equal distances at equal periods of time.
5. This means that the body is at rest.

3

(A) 1. Because the train moves forward or backward in a straight path or curved path or combination of both.
2. Because $V = d/t$ so, the speed is inversely proportional to the time taken, when the distance is fixed.

(B) It helps us in identifying the speed of cars and planes directly.

4

(A) 1. $V_1 = \dfrac{d}{t} = \dfrac{80}{4} = 20$ m/sec.

$V_2 = \dfrac{120}{6} = 20$ m/sec.

2. Regular speed, because the object covers equal distances at equal periods of time.

(B) 1. The speed of the train $= \dfrac{72 \times 1000}{60 \times 60} = 20$ m/sec.

2. The speed of the bird = 20 m/sec. ,so the speed of the train equals the speed of the bird equals 20 m/sec.

Worksheet ❷

1

1. average – regular.
2. position of the observer.
3. total distance – total time.   4. same

2

(A) 1. This means that the total distance covered by the moving car through one hour equals 60 km.
2. It is the speed of a moving object relative to a constant or a moving observer.
3. This means that the observer moves with the same speed and in the same direction of the moving object.
4. This means that the body covers unequal distances at equal periods of time.

(B) *Answer by yourself.*

3

1. Because the car's speed changes according to the conditions of the road and the traffic.
2. Because the relative speed equals the difference between their speeds equals zero.
3. Because it covers equal distances at unequal periods of time or it covers unequal distances at equal periods of time.

4

1. t = 1 h

d = 1000 km.

$V = \dfrac{d}{t} = \dfrac{1000}{1} = 1000$ km/h

$1000 \times \dfrac{5}{18} = 277.7$ m/sec.

2. $t_1 = \dfrac{d}{v_1} = \dfrac{180}{90} = 2$ h.

$t_2 = \dfrac{d}{V_2} = \dfrac{180}{100} = 1.8$ h

The time difference = 2 – 1.8 = 0.2 h

3. (a) $d_1 = v_1 \times t_1 = 25 \times 5 = 125$ m.

$d_2 = v_2 \times t_2 = 22 \times 7 = 154$ m.

Total distance $= d_1 + d_2 = 125 + 154 = 279$ m.

(b) $\overline{V} = \dfrac{\text{Total distance}}{t_1 + t_2} = \dfrac{279}{5 + 7} = 23.25$ m/sec.

4. (a) Average speed $(\overline{V}) = \dfrac{\text{Total distance}}{\text{Total time}}$

$= \dfrac{14 + 16 + 11 + 16}{8 + 10 + 20 + 12} = 1.14$ km/min.

(b) $v_1 = \dfrac{d_1}{t_1} = \dfrac{14}{8} = 1.75$ km/min.

$v_2 = \dfrac{d_2}{t_2} = \dfrac{16}{10} = 1.6$ km/min.

$v_3 = \dfrac{d_3}{t_3} = \dfrac{11}{20} = 0.55$ km/min.

$v_4 = \dfrac{d_4}{t_4} = \dfrac{16}{12} = 1.33$ km/min.

1. Stage (1) (1.75 km/min).
2. Stage (3) (0.55 km/min).

Worksheet 3

1
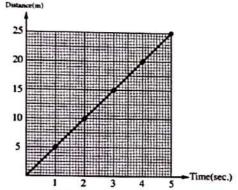
(A) 1. straight – origin.　　2. parallel – time
(B) (1) The body moves at a regular speed.
　　(2) The body is at rest.
　　(3) The body moves at an irregular speed.

2

(A) 1. This means that the body moves at a regular speed.
　　2. This means that The speed of the body is
　　　 50 m/sec. or km/h.
(B) - Predicting of the relation between certain
　　　physical quantities.
　　- Understanding of practical results.
　　- Describing of the physical phenomena in an
　　　easier way.

3

1.

Distance(m)

2. The speed = $\dfrac{10}{2} = \dfrac{15}{3}$ = 5 m/sec.
3. Regular speed, because the (distance-time) graph
　 is a straight line passing through the origin point.
　 (ratio d/t is constant).

4 1. [BC] 2. [AB]

Worksheet 4

1

(A) 1. d　　　　2. b　　　　3. d
(B) Because the object which moves with acceleration,
　　its speed changes as the time passes.

2

(A) 1. This means that the body moves at a regular speed.
　　2. This means that the object's speed decreases by
　　　 5 m/sec. each one second.
　　3. This means that the body moves with
　　　 accelerating motion (positive acceleration).
(B) a = $\dfrac{V_2 - V_1}{\Delta t}$　　　 $-2 = \dfrac{V_2 - 80}{12}$
　　$V_2 - 80 = -24$　　 $\therefore V_2 = 56$ m/sec.

48

3
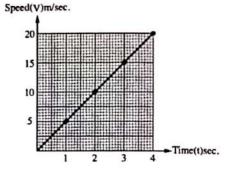
(A) 1. m/sec.² or km/h.²　　　 2. initial – final
　　3. zero – positive
(B) It is the change of an object speed in one second in
　　a specific direction.

4

(A)

Speed(V)m/sec.

(B) 1. [BC]　　　 2. [CD]　　　 3. [AB]

Worksheet 5

1 1. a　　 2. c　　 3. a　　 4. b　　 5. b

2
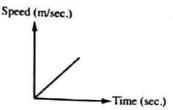
(A) 1. (✘) Speed ...　　　　　 2. (✔)
　　3. (✘) Speedometer ...
(B) 1. The body's speed decreases by passing time
　　　 and the movement is described as decelerating
　　　 motion (negative acceleration).
　　2. The acceleration equals zero.
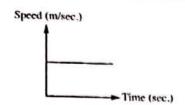
3

(A) 1. metre – metre/sec.²　　　 2. Motion
　　3. accelerating
(B) 1. When the object covers equal distances at
　　　 unequal periods of time (or unequal distances at
　　　 equal periods of time).
　　2. When the object covers this distance through
　　　 a unit time.

4

(A) *Answer by yourself.*
(B) 1.

Speed (m/sec.)

2.

Speed (m/sec.)

Time (sec.)

Worksheet 6

1

(A) 1. a   2. a   3. a   4. b   5. b

(B) 1. Because speed is determined by magnitude only, while velocity is determined by magnitude and direction.

2. Because the direction of wind affects the velocity of the plane and hence the time of the trip and the amount of the fuel consumed.

2

(A) 1. It is the physical quantity that has magnitude only and has no direction.

2. It is the length of the shortest straight line between two positions (primary position and final position).

3. It is the physical quantity that has magnitude and direction.

(B) 1. Velocity – speed

2. Displacement – Time.   3. scalars – vectors.

3 *Look at the main book on page (83).*

4

(1) Displacement = Velocity × Time.

a. Displacement after 2 sec. = 10 × 2 = 20 m. in the east direction.

b. Displacement after 5 sec. = 10 × 5 = 50 m. in the east direction.

(2) Distance = 60 + 40 + 60 + 40 = 200 m.

Displacement = zero.

(3) 1. Total distance = 2 + 5 + 1 + 3 + 1 = 12 km.

2. Displacement = 5 – 3 = 2 km in the direction $\overrightarrow{AF}$.

3. Velocity = $\dfrac{\text{Displacement}}{\text{Total time}}$ = $\dfrac{2}{0.033}$ = 60.6 km/h. (in eastward direction $\overrightarrow{AF}$).

(4) 1. Distance = 30 + 40 = 70 m.

2. Average speed = $\dfrac{\text{Total distance}}{\text{Total time}}$ = $\dfrac{70}{7}$ = 10 m/sec.

(5) 1. Total distance = 20 + 40 + 20 = 80 m.

2. Total time = 10 + 20 + 10 = 40 sec.

3. Average velocity = $\dfrac{\text{Displacement}}{\text{Total time}}$ = $\dfrac{40}{40}$ = 1 m/sec. (in the east direction $\overrightarrow{AD}$)

4. The direct line between point (A) and point (D) in the direction $\overrightarrow{AD}$ represents the displacement.

General Exercise of the School Book **on Unit One**

1 1. b   2. c   3. a   4. c   5. a
   6. b   7. a   8. c   9. c   10. a

2

1. 10   2. 5

3

1. $V_1 = 0$ $V_2 = 25$ m/sec.   t = 10 sec.

$a = \dfrac{V_2 - V_1}{t} = \dfrac{25 - 0}{10} = 2.5$ m/sec^2.

2. • For the car :

$V_1 = 20$ m/sec. $V_2 = 25$ m/sec.

$\Delta t = 2.5$ sec.

$a = \dfrac{25 - 20}{2.5} = \dfrac{5}{2.5} = 2$ m/sec^2.

• For the bike :

$V_1 = 0$ $V_2 = 5$ m/sec.

$\Delta t = 1$ sec.

$a = \dfrac{5 - 0}{1} = 5$ m/sec^2.

∴ The bike moves at a greater acceleration.

4

(1) 20   (2) 50   (3) 12

Model Exam 1 on Unit 1

1

(A) 1. Speed – velocity   2. distance – time

3. m/sec. – m/sec^2

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Ⓑ

Points of comparison	Distance	Displacement
Definition :	It is the actual length of the path that a moving object covers from the starting point to the ending point.	It is the distance covered in a certain direction between the starting point and the ending point.
Kind :	Scalar quantity.	Vector quantity.

2
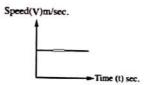
Ⓐ 1. This means that the total distance covered by the moving car through one hour equals 50 km.

2. The average velocity of this object equals 2 m/sec in the northward direction.

Ⓑ 1. $d = V \times t = 10 \times 4 = 40$ m.

2. 30 m/sec.

3. $a = \dfrac{V_2 - V_1}{\Delta t} = \dfrac{0 - 30}{4} = -7.5$ m/sec².

Negative acceleration.

3
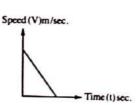
Ⓐ 1. Relative speed.   2. Uniform acceleration.

Ⓑ 1.

Speed(V)m/sec.
Time (t) sec.

2.

Speed (V)m/sec.
Time (t) sec.

Ⓒ 1. b   2. a   3. b   4. a   5. c

4

Ⓐ $v_2 = (a \times t) + v_1$

The first car $(v_2) = (-2 \times 6) + 20 = 8$ m/sec.

The second car $(v_2) = (5 \times 6) + 5 = 35$ m/sec.

∵ The two cars move in the opposite direction.

∴ The relative speed of the first car according to the driver in the second car $= 8 + 35 = 43$ m/sec.

Ⓑ 1. (✓)   2. (✘) .... decreases ....

3. (✘) .... vector physical quantities.

Model Exam 2 on Unit 1

1

Ⓐ 1. Displacement   2. Motion   3. Acceleration

Ⓑ $d = V \times t$

$d_1 = 100 \times 1 = 100$ km.

$d_2 = 80 \times 1 = 80$ km.

$d_3 = 80 \times 1 = 80$ km.

$d_4 = 40 \times 1 = 40$ km.

$\overline{V} = \dfrac{100 + 80 + 80 + 40}{4} = 75$ km/h.

Ⓒ 1. (D)   2. (A)   3. (C)   4. (B)

2

Ⓐ 1. c   2. c   3. b   4. c   5. c

Ⓑ 1. Because the speed of car (A) $= \dfrac{d}{t} = \dfrac{60}{6} = 10$ m/sec.

, while the speed of car (B) $= \dfrac{d}{t} = \dfrac{64}{8} = 8$ m/sec.

So, car (A) is faster than car (B).

2. Because there is no change in the object's speed by passing time, so acceleration equals zero.

3

Ⓐ 1. the distance covered in that time.

2. magnitude – direction.

3. metre – kilogram.   4. $\dfrac{\text{Displacement}}{\text{Total time}}$

Ⓑ

Points of comparison	Speed	Velocity
Definition :	It is the rate of change of distance.	It is the rate of change of displacement.
Kind :	Scalar quantity.	Vector quantity.
Measuring unit :	m/sec. or km/h.	m/sec. or km/h.

4

Ⓐ 1.

Distance (m)
Time (sec.)

2. $V = \dfrac{d}{t} = \dfrac{20}{10} = 2$ m/sec.

(B) 1. This means that the final position of movement of this object is the same primary position.

2. It is an acceleration by which an object moves in a straight line when its speed increases by equal values through equal periods of time.

(C) $V_1 = 7.5$ m/sec. $a = 10$ m/sec^2.

$V_2 = 4 \times 7.5 = 30$ m/sec.

$t = ?$

$\because a = \dfrac{V_2 - V_1}{t}$

$\therefore 10 = \dfrac{30 - 7.5}{t}$

$\therefore t = \dfrac{22.5}{10} = 2.25$ sec.

Unit Two

Worksheet 7

1

1. the outer

2. double

3. plane mirror – spherical mirror.

4. erect – virtual

5. parallel – reflected

6. Convex – concave

2

(A) *Look at the main book on pages (110 & 111).*

(B) 1. c   2. c   3. b   4. (A) d (B) b

3

(A) 1. Because the mirrors of the cars in front of the ambulance car, form a laterally inverted image for this word, and thus it appears laterally corrected to the drivers.

2. Because the angle of incidence equals the angle of reflection equals zero.

(B) 1. (✗) .... = $\frac{1}{2}$ × ....

2. (✗) .... is perpendicular to ....

3. (✓)

4. (✗) .... in the convex mirror.
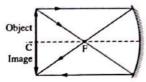
4

(A) 1. Focus of the mirror.

2. Second law of light reflection.

(B) Angle of incidence = Angle of reflection.

(C) Angle of incidence = 50°

Worksheet 8

1
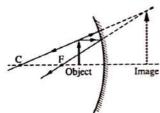
(A) 1.

2.

(B) 1. It is the image that cannot be received on a screen.

2. It is the image that can be received on a screen.

2

(A)

P.O.C.	Convex mirror	Concave mirror
- The position of the center of curvature :	It lies behind the reflecting surface.	It lies in front of the reflecting surface.
- Way to form virtual image :	Wherever the object is put in front of it at any distance the image is virtual.	The object is put at a distance less than the focal length.

(B) 1. b   2. c   3. b   4. d

3

(A) 1. (1) In shaving to get an enlarged and erect image of the face.

(2) In some types of telescopes to monitor the space and also to form enlarged and near images of the celestial bodies.
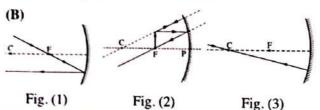
(3) By dentists to form magnified images of the teeth at the back of the mouth cavity (molars teeth).

2. (1) In cars on the both sides of the driver, as it forms an erect and smaller image for the way behind the car.

51

(2) At shopping centers to allow high rates of security at these places.

(3) At cars park to monitor cars movement at the park to avoid accidents.

(B)

Fig. (1)   Fig. (2)   Fig. (3)

4
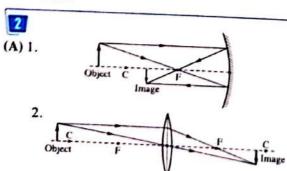
(A) 1. 40 cm.
2. greater than the double – inverted
3. concave

(B) 1. Because the concave mirror collects the reflected light rays falling on it in one point (focus) generating high heat energy.
2. Because it forms an erect and smaller image for the way behind the car.
3. Because it is formed behind the mirror from the intersection of the extensions of the reflected light rays and it cannot be received on a screen.

(C) Small, upright and virtual.

Worksheet 9

1
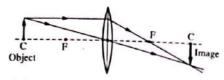
1. transparent – refracts
2. concave lens – convex lens.
3. focus – principal axis.
4. focus – center of curvature.
5. converges the refracted– diverges the reflected
6. the focus.

2

(A) 1.

2.

(B) 1. Because it refracts the rays after they pass through it away from the principal axis.
2. Because the penetrating rays from a lens don't meet and pass through a parallel way.
3. Because they have two spherical surfaces, each surface has a center.

3

(A) 1.

2. Real, inverted and equal to the object.
3. 4 cm.

$\because f = 3$ cm , $f = \frac{1}{2} r$
$\therefore 3 = \frac{r}{2}$, $r = 6$ cm.

(B) 1. It is the straight line that joins between the two centers of curvature of the lens passing by the optical center of the lens.
2. This means that the distance between the focus and the optical center of the convex lens = 5 cm.
3. It is the center of the sphere, where this face is a part of it.

4

(A) 1. b   2. a   3. d   4. c   5. b   6. d

(B) *Look at the main book on pages (158 & 159).*

Worksheet 10

1 **(A)**

P.O.C.	Long-sightedness	Short-sightedness
- Definition :	It is a vision defect through which far objects only can be seen clearly, but close objects are not seen clearly.	It is a vision defect through which near objects can be seen clearly but far objects seem distorted.
- The position of the formed image :	Behind the retina.	In front of the retina.
- Treatment :	By using a convex lens.	By using a concave lens.

(B) *Look at the main book on page (155).*

2

(A) 1. (✗)   2. (✓)   3. (✓)   4. (✓)
(B) 1. d   2. a   3. a   4. d

3

(A) 1. Because the real image is formed as a result of the intersection of the refracted light rays and as the concave lens diverges the refracted light rays, so the image formed by the concave lens cannot be received on a screen.

2. Because they stick directly to the eye cornea by the eye fluid instead of the glasses.

3. Due to :
   – The increase in the eyeball diameter.
   – The increase in convexity of the eye lens surface.

(B) 1. Cataract.   2. Transparent plastic.

4

1. Figure (1) , because the refracted rays are collected on the retina.

2. Figure (2) , because this case is a long-sightedness. and the convex lens collects the rays, so the image of the object is formed on the retina.

General Exercise of the School Book **on Unit Two**

1

1. b   2. c   3. c   4. a   5. c
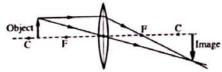
2

1. the pole of the mirror.
2. the principal axis of the mirror.
3. the focal length of the mirror.
4. 40 cm.   5. convex

3

1. Because the radius of the thin lens is bigger than that of the thick lens.

2. Because the concave lens diverges the rays coming from a far object, so the image is formed on the retina.

3. Because the convex lens collects the rays, so the image of the object is formed on the retina.

4. Because the penetrating rays from a lens don't meet and pass through a parallel way.

5. Because convex lens has two spherical surfaces, but the concave mirror has one spherical surface.
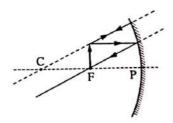
4

● Position of the formed image : After the centre of curvature.

● Properties of the formed image :
   - Real.   - Inverted.   - Magnified

Model Exam **1** **on Unit 2**

1 (A) 1. b   2. b   3. a   4. d

(B) ● The increase in the eyeball diameter.
   ● The increase in the convexity of the eye lens surface.

(C) 1. It is the point of collection of the extensions of refracted light rays.

2. It is the angle between the reflected light ray and the normal.

2 (A) 1. It has one principal axis, because it has one center of curvature and one pole, while it has uncountable number of secondary axes, because any straight line passes by its center of curvature except the principal axis is considered as a secondary axis.

2. Because the angle of incidence and the angle of reflection equal zero.

3. Because the mirror has one spherical surface, while the lens has two circular surfaces.

(B) 1. (✗)   2. (✓)   3. (✗)   4. (✓)

3 (A) 1. The principal axis of the lens.
   2. Convex mirror.
   3. Light reflection.   4. The pole of the mirror.

(B)
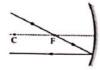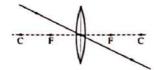
Properties of the reflected light rays :
(1) The light ray that falls parallel to the principal axis, is reflected passing through the focus.

(2) The light ray that passes through the centre of curvature, is reflected back on itself.

4 (A) 1. Convex lens.   2. 10 cm.
   3. the radius of curvature of the lens – 20 cm.

(B) (1) The plane mirror.
   (2) The concave mirror (converging).
   (3) The convex mirror (diverging)

© 1.   2.

3.   4.

Model Exam ② on Unit 2

1 1. concave lens – convex lens.
2. small – upright
3. long-sightedness.
4. center of curvature – optical center of the lens.
5. diverges
6. a concave
7. concave

2 Ⓐ r = 2 f   r = 2 × 6 = 12 cm

Ⓑ *1. Look at the main book on page (127).*
2. Look at the main book on page (168).

3 Ⓐ 1. Long-sightedness.
2. This eye can see far objects only clearly but close objects are not seen clearly.
3. Convex lens.

Ⓑ (1) The image is upright.
(2) The image is equal to the object.
(3) The image is laterally inverted (reversed).
(4) The image is virtual (cannot be received on a screen).

4 Ⓐ The position of the image :
Between the focus and the center of curvature.
- The properties of the formed image :
- Real   - Inverted   - Small

Ⓑ 1. Still
2. parallel
3. parallel to the principal axis.
4. concave mirror

© 1. d   2. d

Unit Three

Worksheet **11**

1
(A) 1. The universe.   2. Galaxies clusters.
3. The solar system.   4. Big Bang theory.
(B) 1. Milky Way galaxy.   2. The Sun.
(C) The Earth will leave its orbit and float in a random fashion in space and this leads to the vanish of the life.

2
(A) 1. galaxy – Sun.   2. light year – 9.46×10^{12}
3. decreases – slower. 4. 5000 – 10000
5. high – small   6. centre – spiral
(B) 1. It is a group of stars that rotate together in cosmic space by the effect of gravity.
2. It is continuous separation between galaxies in the space as a result of their regular movement.
(C) 1. hydrogen   2. 3000   3. stars

3
(A) 1. b   2. b   3. c   4. b
5. c   6. d
(B) 1. Because it appears in the sky at night as a splashing milk or spreading straw.
2. Due to the movement of galaxies apart.
3. Due to the Sun gravity.
(C) 1. 15000 million years ago.
2. Within 2000 : 3000 million years from Big Bang.
3. After 10000 million years from Big Bang.

4
(A) *Answer by yourself.*
(B) 1. (✓)   2. (✗)
(C) *Look at the main book on pages (195 & 196).*

Worksheet **12**

1
(A) 1. Laplace.   2. contracted – increased.
3. nebular theory.   4. gaseous – Sun
5. the Sun – star rather than the Sun.
6. solar telescope – Hubble telescope.
(B) 1. d. C   2. c. A   3. b. B

2

(A) *Look at the main book on page (203).*

(B) 1. Due to the effect of centrifugal force that is resulted from the rotation of the nebula around itself.

2. Due to the occurrence of sudden and violent nuclear reactions.

3

(A) 1. There is something that looks like clouds or nebula in the space.

2. The space contains many cloudy rings surrounding some planets such as the rings of Saturn planet.

(B) 1. The bombing of the star's nucleus away from the gravity of the Sun and a gaseous cloud from this star remained around the Sun.

2. The star attracted the Sun to it which led to a great expansion in the part of the Sun facing it.

General Exercise of the School Book **on Unit Three**

1

1. (✓)   2. (✗) ... in the galaxy.   3. (✓)

4. (✗) ... around the Sun.

5. (✗) Stars ... centre of the galaxy.   6. (✓)

2

1. Due to the movement of the galaxies apart.

2. As a result of their regular movement.

3 *Answer by yourself.*

Model Exam on **Unit 3**

1 (A) 1. It is a glowing gaseous sphere revolving around itself from which the solar system were originated.

2. It is the distance covered with light in one year and it equals 9.46×10^{12} km.

3. It is a theory that explains the origin of the universe from a massive explosion since 15000 million years and resulted in it all forms of matter, energy, time and space followed by continuous expansion and changing processes.

4. They are the greatest units that form the universe.

(B) 1. galaxy.   2. Galaxies clusters.
3. disc

2 (A) 1. Universe.   2. Gravity.
3. The solar system.   4. The Sun.

(B) 1. As a result of their regular movement.

2. Due to the gravity of the Sun.

3. Because the distances between stars are very large.

3 (A) 1. hydrogen – helium.

2. gaseous sphere

(B) 1. *Look at the main book on pages (204 & 205)*
2. *Look at the main book on pages (201 & 202)*

4 (A) • Fig. (2) ⟶ Fig. (3) ⟶ Fig. (4) ⟶ Fig. (1)
• *Look at the main book on page (200)*

(B) 1. b   2. b   3. b   4. a
5. b   6. c

Unit Four

Worksheet 13

1

1. Centromere.　　　　2. Chromosome.
3. Interphase.　　　　4. Metaphase.

2

(A) 1. Chromosomes.
　　2. The number of chromosomes is different from a species to another.
　　3. It carries the genes that carry the genetic traits of the living organism.

(B) 1. metaphase.　　2. diploid　　3. prophase.

3

1. different – fixed　　　　2. Mitosis – meiosis
3. cell's nucleus – chromosomes
4. somatic cells – reproductive cells.
5. 46 – 23　　　　6. Mitotic

4

(A) 1. To prepare the cell for division through some important biological processes, where the amount of genetic material duplicates.
　　2. To separate chromatids which form chromosomes from each other in this phase.

(B) 1. Telophase　　　　2. Metaphase
　　3. Prophase　　　　4. Anaphase

(C) 1. c　　2. a　　3. d　　4. b

Worksheet 14

1

(A) *Look at the main book on page (239)*

(B) *Look at the main book on page (237)*

2

(A) 1. a　　2. a　　3. c　　4. d

(B) *1. & 2. Look at the main book on page (236)*

3

(A) 1. (✗)　　2. (✓)　　3. (✗)　　4. (✗)
　　5. (✗)　　6. (✗)　　7. (✗)
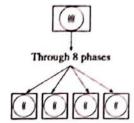
(B) 1. Due to the occurrence of the crossing over phenomenon during it.

2. Because the mitotic division occurs in a cell contains (2N) chromosomes and before it, an interphase occurs, while second meiotic division occurs in a cell contains (N) chromosomes and the interphase doesn't occur before it.

3. Because in which, very small molecules are used which their lengths are measured by nanometer unit.

4

1.

Through 8 phases

2. Meiosis.

3. It occurs in the reproductive cells.

- **Its importance :**
It plays an important role in the formation of male and female gametes.

Worksheet 15

1

(A) 1. Zygote　　　　2. Fertilization
　　3. Spore propagation

(B) 1. Because the offspring resulting from the sexual reproduction combines the genetic traits from two parents.

　　2. Because it occurs through one parental individual and through a mitotic division as the new individual gets a genetic copy identical to the parent.

　　3. Because it produces two cells identical to the original cell.

2

(A) 1. budding.　　　　2. seeds.
　　3. binary fission.　　4. Asexual reproduction

(B) 1. ① Spores　　　　② Sporangium
　　2. Sporogony (spore propagation).
　　3. It grows to give out a new organism (fungus).

3

1. binary fission – budding.　　2. genetic traits
3. colony　　　　　　　　　　4. one – two.
5. Budding – binary fission

4

(A) 1. It is a biological process where the living organism produces new individuals of the same kind and thus, ensuring its continuity.

2. It is the ability of the missing part from some living organisms to grow forming a complete organism.

(B) 1. d   2. a   3. b   4. d

General Exercise of the School Book   **on Unit Four**

1

1. (✗) ... mitotic ...   2. (✗) ... meiosis ...
3. (✗) ... prophase ...   4. (✗) ... four cells ...
5. (✓)   6. (✗) ... reproductive cells ...

2

1. Interphase.   2. Metaphase.   3. Telophase.
4. Crossing over phenomenon.   5. Mitosis.
6. Zygote.   7. Reproduction by binary fission.

3 *Look at the main book on page (268).*

4 *Look at the main book on page (237).*

5 1. *Look at the main book on page (239).*
2. *Look at the main book on page (269).*

6

1. Due to the formation of zygote which contains the whole number of chromosomes (2N) which is formed by the combination of male gamete (N) with female gamete (N).

2. Because the offspring resulting from sexual reproduction combines the genetic traits from two parents.

3. Because it occurs through one parental individual and through a mitotic division as the new individual gets a genetic copy identical to the parent.

7

1. – The resulted cells are identical to the parental cell.
   – Because they are resulted the asexual reproduction by mitotic division.

2. – The offspring resulted from the germination of seeds has new genetic traits that combines the parent's traits.

– Because it is resulted through the sexual reproduction by meiotic division.

Model Exam **1** **on Unit 4**

1 1. Anaphase 2   2. Telophase 1
3. Metaphase 1   4. Telophase 2
5. Metaphase 2   6. Prophase 1
6 ⟶ 3 ⟶ 2 ⟶ 5 ⟶ 1 ⟶ 4

2 **(A)** 1. Because it occurs through one parental individual and through a mitotic division as the new individual gets a genetic copy identical to the parent.

2. Because the produced cells contain half the number of chromosomes of the parent cell.

3. Because it contributes in genes exchanging between the two homologous chromosome's chromatids and distributing them randomly in the gametes.

(B) 1. Zygote.   2. Metaphase.
3. Sexual reproduction.   4. Mitotic division.

3 **(A)** 1. anaphase I of meiosis.

2.

(B) 1. (✗)   2. (✗)   3. (✗)   4. (✗)
(C) 1. *Look at the main book on page (264).*
2.

The spore	The zygote
- It is resulted from some algae and fungi.	- It is produced from the combination of a male gamete (N) and a female gamete (N).
- It grows forming a new individual with genetic traits identical to the parent individual.	- It grows forming a new offspring with traits of its parents.

4 **(A)** 1. *Look at the main book on page (239).*
2. *Answer by yourself.*

(B) Fig. (1) Reproduction by binary fission in bacteria.

Fig. (2) Reproduction by sporogony in bread mould fungus.

Fig. (3) Reproduction by regeneration in starfish.

57

Model Exam **2** on **Unit 4**

1 (A) 1. It is a biological process, where the living organism produces new individuals of the same kind and thus, ensuring its continuity.

2. It is a phenomenon that takes place at the end of prophase I and in which some parts of the two inner chromatids of each tetrad are exchanged to produce new genetic arrangements.

(B) 1. 46   2. 92   3. 46   4. zero

(C) 1. the chromosome – nuclear acid (DNA)

2. chromatid.

3. centromere.

2 (A) 1. b 2. d   3. a   4. a   5. d   6. a

(B) *Look at the main book on page (269)*.

3 (A) 1. fixed – different

2. seeds – vegetative

3. homologous – a tetrad.   4. zygote
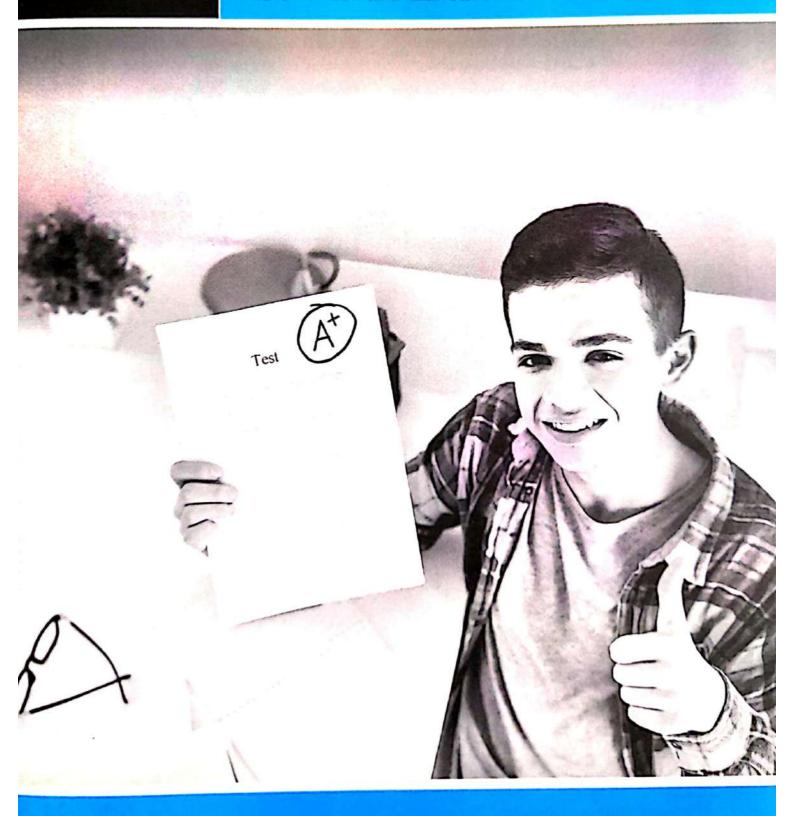
(B) 1. mitotic

2. Meiotic   3. prophase.

4 (A) 1. d 2. b   3. a   4. c

(B) 1. Because when the male gamete (N) fuses with the female gamete (N), the zygote is formed which contains the original number of the organism's chromosomes (2N).

2. To prepare the cell for division through some important biological processes, where the amount of genetic material duplicates.

(C) 32 chromosomes.

PART
3

Guide Answers
of Final Examinations

1 Cairo Governorate

1

(A) 1. real   2. prophase

     3. galaxy

     4. centromere – chromatid

(B) 1. It is the phenomenon of the light bouncing of (returning back) in the same medium, when it strikes a reflecting surface.

     2. It is the total distance covered by the moving object divided by the total time taken to cover this distance.

     3. It is a biological process, where the living organism produces new individuals of the same kind and thus, ensuring its continuity.

(C) $V_1 = 0$ $V_2 = 36$ m/sec $t = 9$ sec.

$$\because a = \frac{V_2 - V_1}{t}$$
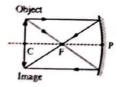
$$\therefore a = \frac{36 - 0}{9} = 4 \text{ m/sec}^2 \text{ (positive acceleration)}$$

2

(A) 1. d   2. c   3. d   4. d   5. a

(B) 1. Scalar   2. Vector

(C)

The properties of the image : real, inverted and equal to the object.

3

(A) 1. regular speed   2. eight

     3. double   4. Laplace'

     5. concave lens.   6. Velocity

(B) 1. The zygote will be formed.

     2. It will refract parallel to the principal axis.

(C) 1. Because the image of near objects, is formed behind the retina.

     2. Because that, the focal length equals half the radius of curvature.

$$F = \frac{1}{2} r$$

4

(A) 1. Displacement.   2. Acceleration.

     3. Reflecting angle.   4. Regeneration.

     5. Scalar physical quantity.   6. Motion.

(B) 1. **Acceleration** : is the increasing of the object speed as the time passes.

     Deceleration : is the decreasing of the object speed as the time passes.

     2. **Somatic cells** : Mitotic cell division.

     Reproductive cells : Meiotic cell division
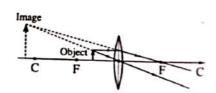
2 Giza Governorate

1

(A) 1. b   2. d   3. a   4. c

(B) 1. $\overline{V} = \frac{50}{5} = 10$ m/sec.   2. $\overline{V} = \frac{50}{20} = 2.5$ m/sec.

(C) (1) 50°   (2) zero°

2

(A) 1. negative   2. 20 cm

     3. light year   4. mitosis

(B) 1. Convex lens.

     2.

(C) 1. Fertilization process occurs.

     2. Body moves with zero acceleration.

3

(A) 1. Displacement.   2. Focal length.

     3. Crossing over phenomenon.

     4. Univerce.

(B) 1.

Speed	Velocity
Distance covered through a unit time.	Displacement covered through a unit time.

     2.

Amoeba	Yeast fungus
Binary Fission	Budding.

(C) 1. Metaphase.   2. Interphase.

4

(A) 1. magnitude and direction.

    2. refract   3. Nebular

    4. haploid

(B) 1. Because it covers unequal distances at unequal periods of time.

    2. Because the new individual gets the genetic traits from two sources (male and female gametes), and the crossing over phenomenon occurs during gametes formation.

(C) 1. Both car and the observer move with the same speed and direction.

    2. The produced gamete contains half the number of chromosomes in the reproductive cell.

---

3   **Alex. Governorate**

1

(A) 1. distance - a scalar   2. plane

    3. mitosis

(B) $\overline{V} = \dfrac{240 + 240}{16 + 120} = \dfrac{480}{136} = 3.5$ m/sec.

(C) 1. The space which contains the galaxies, stars, planets, moons and all living organisms.

    2. The ability of the missing part in some living organisms to grow forming a complete organism identical to the parent individual.

2

(A) 1. b   2. d   3. a   4. d   5. d

(B) 1. Answer by yourself.

    2. Because the produced individual has the same number of chromosomes of the parental individual.

(C) metre or kilometre.

3

(A) 1. Relative speed.   2. Convex mirror.

    3. Galaxy.   4. Sporangia.

(B) 1. When it passes through its optical centre.

    2. When the speed decreases by equal values in equal periods of time.

(C) 1. In placing an object at the centre of curvature of a concave mirror.

    2. (a) Crossing over phenomenon.

        (b) At the end of prophase I.

4

(A) 1. AB and CD

    2. $a = \dfrac{V_2 - V_1}{t} = \dfrac{20 - 20}{10} =$ zero

(B)

	Short- sightedness	Long- sightedness
The radius of the eyeball	increased	decreased
The type of the lens	concave	convex

(C) 1. Controls the planets revolving around it.

    2. Carry the genetic information of the living organism.

    3. Forming the pollen grains in the flowering plants.

---

4   **Kalyoubia Governorate**

1

(A) 1. a   2. d   3. a   4. a   5. d

(B) 1. Huge amounts of gaseous materials resulted due to this explosion, which cooled forming the planets.

    2. The animal will compensate its missing arm through regeneration, and the missing arm will form a new individual through reproduction by regeneration.

    3. No image is formed.

(C) 1. Crossing over phenomenon.

    2. At the end of prophase I.

    3. Meiosis.

    4. There is no genetic variation in the individuals of the same kind.

2

(A) 1. Vegetative reproduction.

    2. Distance.   3. Galaxies.

    4. Chromosomes.   5. Concave lens.

(B) $\because a = \dfrac{V_2 - V_1}{t}$

    $\therefore V_2 = V_1 + a\,t$

    $= 10 + (5 \times 5) = 35$ m/sec.

    $\because$ The two cars are opposite in direction.

    $\therefore$ Relative speed $= 30 + 35 = 65$ m/sec.

(C) 1. When the body moves in a certain direction and in a straight line.

2. When it falls passing through the centre of curvature.

3

(A) 1. 60° 2. 1m/sec. 3. budding

4. 2r 5. increases to the double

(B) (1) zero. (2) 25 m/sec.

(3) zero. (4) −5 m/sec².

(5) The car moves with positive acceleration.

(6) The car moves with zero acceleration.

(C) 1.

Regular speed	Irregular speed
The body covers equal distances in equal periods of time.	The body covers unequal distances in equal periods of time.
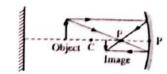
2.

Virtual image of the concave lens	Virtual image of the convex lens
Diminished	Magnified

4

(A) 1. Because the wind direction detects the time of the trip and also the amount of the fuel consumed, due to it affects the speed of the plane.

2. Because mitotic division leads to growth which is important for child's body.

3. Due to the continous movement of galaxies away from each others.

4. Because of the plane mirror forms a laterally inverted image.

5. Because it developed throught one parental individual.

(B) 1.

2. The properties of the formed image : real - inverted - diminished

(C) 1. Prophase. 2. Anaphase.

---

5 Menofia Governorate

1

(A) 1. Virtual image.

2. Principal axis of the mirror.

3. Interphase. 4. Convex lens.

5. Asexual reproduction.

(B) 1. Because ΔV = zero, whereas acceleration is the rate of change of velocity so it also equals zero.

2. Because the newly formed individual takes the genetic material from male and female, and also due to the occurance of crossing over phenomenon during gametes formation.

3. Because gametes are produced from meiosis, which is a reduction division.

(C) 1. $V = \dfrac{300}{50} = 6$ m/sec.

2. $V = \dfrac{300 + 300}{10 + 50} = \dfrac{600}{60} = 10$ m/sec.

2

(A) 1. The focal length = 10 cm.

2. The displacement = 100 m.

(B) The animal will compensate its missing arm through regeneration, and the missing arm will form a new individual through reproduction by regeneration.

(C) 1.

Acceleration	Mass
Vector	Scalar.

2.

Bread mold fungus	Sponge
Sporogony.	Budding.

3.

Big Bang theory	Nebular theory
Explain the origin of the universe.	Explain the origin of the solar system.

4.

A train	A car
V = 20 m/sec.	V = 30 m/sec.

5.

Mitotic division	Meiotic division
Somatic cells.	Reproductive cells.

Scanned with CamScanner

(D) 1. ∵ The formed image is equal to the object.

∴ The object placed at the centre of curvature.

$F = \dfrac{1}{2}r = \dfrac{1}{2} \times 10 = 5$ cm.

2.

3

(A) 1. During anaphase the spindle fibers begin to shrink and two identical groups of chromosomes are formed at the two poles of the cell.

2. It contains the nucleic acid (DNA) that carries the genetic traits of the living organism.

(B) 1. Concave lens.　　2. Concave mirror.

(C) 1. Chamberlain and Moulton.

2. liver transplantation.

3. Crossing over.

4. Solar telescope.

(D) 1. Distance = 12 + 8 = 20 m.

2. Displacement = 12 − 8 = 4 m (west).

4

(A) 1. a　　2. d　　3. a　　4. b　　5. d

(B) First :

1. 20　　　2. zero　　　3. 5

Second :

1. 15　　　2. 25

6　Dakahlia Governorate

1
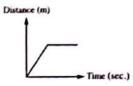
(A) 1. decreases - slower

2. outer - inner

3. centrosome - cytoplasm condensation

4. Vegetative - seeds

(B) 1.

2. (a) Gametes formation.

(b) Fertilization.

(C) 1, 2. Answer by yourself.

(D) 1. Total distance = 10 + 10 = 20 m.

2. Displacement = zero.

3. $V = \dfrac{10}{5} = 2$ m/sec.

2

(A) 1. 1.8　　　　　2. Big Bang

3. The position　　4. on it self

5. The pole　　　6. is equal to

(B) 1. Convex lens.　　　2. F = 6 cm.

(C) 1. The chromosome consists of two chromatids, connected at the centromere.

2. (1) It is the exchange of parts of genetic materials of the two inner chromatids of the tetrad.

(2) It is a very thin lens made of plastic, and can stick to the eye cornea by the eye fluid.

(D) 1. Mushroom fungus reproduce asexually by sporogony.

2. Yeast fungus reproduce asexually by budding.
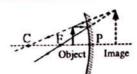
3

(A) 1. Speed.　　　　2. Galaxy.

3. Vritual image.　　4. Microscope.

(B) 1. Because it depends on one parental individual, and occurs through mitosis.

2. Because it collects the ray in one point, which is focus.

3. Because it is a diverging lens.

4. Because there is an inversely relation between speed and time at constant distance.

(C)

	Somatic cell	Reproductive cell
a. Type of division	mitosis	meiosis
b. Number of cells	2	4

(D)

4

(A) 1. a　　2. c　　3. c　　4. d

(B) $V_1 = 90 \times \frac{5}{18} = 25$ m/sec.

$a = \frac{V_2 - V_1}{t} = \frac{0 - 25}{10} = -2.5$ m/sec².

(decelerating motion)

(C) 1. In interphase the cell prepared for division by :
   - Occurrence of some important biological processes.
   - Duplicating the amount of genetic material (DNA).

2. It forms an erect minimized image for the road behind the car.

(D) 1, 2. Answer by yourself.

7 Sharkia Governorate

1

(A) 1. Acceleration. 2. Convex mirror
   3. Milky Way galaxy. 4. Centromere.
   5. Vegetative reproduction.

(B) 1. Virtual, erect and magnified image.
   2. No image is formed.

(C) 1. Interphase.
   2. Before the cell division.
   3. - Occurance of some important biological processes.
      - Duplicating the amount of the genetic material (DNA).

2

(A) 1. vector - scalar   2. Lenses - binoculars
   3. the decrease - near
   4. universe - solar system
   5. mitosis - meiosis

(B) 1. zero
   2. $V_1 = \frac{80}{4} = 20$ m/sec
   $a = \frac{V_2 - V_1}{t} = \frac{0 - 20}{4} = -5$ m/sec²

(C) 1. Anaphase.   2. Prophase.
   3. Telophase.

3

(A) 1. c   2. a   3. b   4. d   5. a
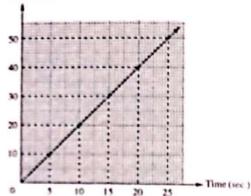
(B) 1. It is the shortest straight line between two position.
   2. It is from the start point to the end point.

(C) 1. 50 km/h.   2. 20 km/h.
   3. The relative speed depends on the observer condition.

4

(A) 1. Because it moves in a straight line or curved line or combination of both.
   2. Due to light reflection.
   3. To see the very small parts of the watch.
   4. Due to the gravity of the Sun.
   5. Because it helps in growth, and compensates the damaged cells.

(B) Answer by yourself.

(C) 1.

Distance (m)

2. $V = \frac{10}{5} = 2$ m/sec.

8 Gharbia Governorate

1

(A) 1. Speed.   2. Fred Hoyle
   3. somatic   4. scalar
   5. real.

(B) 1. They are the arrangement of homologous pairs of chromosomes, where each pair consists of 4 chromatids.
   2. Focal length = 20 cm.
   3. Amount of displacement = 5 cm.

(C) $V_1 = 40$ m/sec $V_2 = 0$ $a = -2$ m/sec²
   $t = \frac{V_2 - V_1}{a}$
   $= \frac{0 - 40}{-2} = 20$ sec.

2

(A) 1. b   2. a   3. c   4. d   5. d
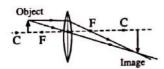
(B) 1. It reproduces by budding forming a new bud, that remain connected to the parent cell forming a colony or separated from the parent cell and becomes as a new fungus.
   2. It will reflected on itself.

3. The light energy transformed into heat energy, that burns and kill the cancer cells only.

(C) 1. It forms the spindle fibers, which play an important role during the cell division.

    2. It forms a virtual, erect and smaller image to the way behind the driver.

3

(A) 1. binary Fission.   2. speedometer.

    3. cornea.   4. nuclear.

    5. Distance.

(B) 1. For preparing the cell for division, by occurance of some biological processes and duplicating the genetic material (DNA).

    2. Because it affects the speed of the plane, and so the time of arrival also the amount of fuel consumed.

    3. Because the relative speed in this case equals the difference between the two equal speed, equals zero.

(C) 1.

    2. Image properties : real, inverted and magnified.

4

(A) 1. Centromere.   2. Motion.

    3. Universe.   4. Optical centre.

    5. Acceleration.

(B) 1.

Pollen grains	Sperms
Anther of flowering plants.	Testes of human and animals.

2.

Average speed	Irregular speed
It is the total distances covered divided by the total periods of time.	It is the speed by which the object moves to cover unequal distances at equal periods of time.

3.

Short - sightedness	Long - sightedness
concave lens	Convex lens

(C) Equals (2 N), because reproduction by regeneration is a type of mitosis.

---

9   Damietta Governorate

1
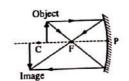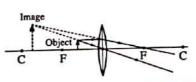
(A) 1. vector - scalar   2. 8

    3. DNA - protein   4. 20

    5. Spiral - Milky Way

    6. sporogony - budding

(B)

Female liver cell	Female ovarian cell
1. Mitosis.	1. Meiosis.
2. 2 cells.	2. 4 cells.
3. 2 N	3. N

(C) 1.

    2.

2

(A) 1. Relative speed.

    2. Continous expansion of the universe.

    3. Crossing over phenomenon.

    4. Spindle Fibers.

(B) 1. Because it is important for growth.

    2. Because the refracted light rays are parallel.

    3. Because its speed changed by time.

(C) Figure (1)

    1. AB   2. BC

Figure (2)

    1. Anaphase 1   2. Meiosis

    3. Gametes formation

3

(A) 1. c   2. a   3. b   4. b   5. d

(B) 1, 2. answer by yourself.

(C) $t = \dfrac{d}{v}$

    $= \dfrac{500}{100} = 5 \, h$

Time of arrival = 7 + 5 = 12 AM

4

(A) 1. metaphase   2. binary fission

3. 2   4. speed is regular.

5. without refraction

(B) 1. Distance = 10 + 10 + 10 + 10 = 40 cm

2. Image properties : real, inverted and equal to the object.

(C) 1. No spindle fibers will be formed.

2. The size of nebula decreases, and its revolving around its axis increases.

3. The animal will compensate its missing arm through regeneration, and the missing arm will form a new individual through reproduction by regeneration.

10 Kafr El-Sheikh Governorate

1

(A) 1. gametes formation - fertilization.

2. Milky Way   3. m/sec.

4. The pole of the mirror.

5. prophase.

(B) 1. equal   2. 8

3. 500   4. plane

2

(A) 1. Chromatids.   2. Principal axis.

3. Velocity.   4. Light reflection.

5. Regeneration.   6. cataract.

(B) 1.

Asexual reproduction	Sexual reproduction
Through one living organism (parental individual).	Through two living organisms (male and female).

2.

Scalar physical quantities	Vector physical quantities
It identified by knowing its magnitude only, like mass.	It identified by knowing its magnitude and direction, like velocity.

3
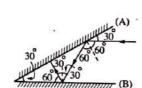
(A) 1, 2. answer by yourself.

(B) 1. Total distance = 500 + 1000 + 500 = 2000 m.

2. Total time = 40 + 100 + 60 = 200 sec.

3. Displacement = 1000 m. northward.

4. Velocity $= \frac{1000}{200} = 5$ m/sec. northward.

5. Average speed $= \frac{2000}{200} = 10$ m/sec.

4

(A) 1. b   2. c   3. b   4. a   5. a   6. a

(B) 1. It will reproduce by budding.

2. The defect will be corrected, where he can see near objects clearly.

11 Behiera Governorate

1
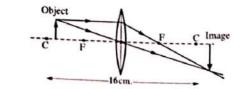
(A) 1. The optical centre of the lens.

2. Vegetative reproduction.

3. Cataract.   4. A tetrad.

5. Deceleration.   6. The nebula.

(B) 1. Because the direction of wind affects the velocity of the plane, so affects also the time of the trip and the amount of the fuel consumed.

2. Because each of male gamete and female gamete contains half number of chromosomes (N), by combination a zygote is formed which containing the whole number of chromosomes (2 N).

(C) 1.

2. Reflecting angle from the mirror (B) = 30°

2

(A) 1. changeble.   2. 10 pairs

3. 80   4. Sporangia

5. Displacement.   6. Laplace

(B) 1. Its speed increases to the double.

2. It reflects back on itself.

(C)

- Image properties : real, inverted and equal to the object.

3

(A) 1. b   2. d   3. b   4. d   5. c   6. a

(B) 1. It forms an erect and smaller image for the way behind the car.

2. It forms the spindle fibers.

(C) 1. Distance = 60 + (60 – 20) = 100 m

$$V = \frac{d}{t} = \frac{100}{10} = 10 \text{ m/sec.}$$

2. Displacement = 20 m $\overrightarrow{AC}$

Velocity = $\frac{\text{displacement}}{\text{time}} = \frac{20}{10} = 2$ m/sec.

4

(A) 1. vector – scalar

2. 25% – 75%

3. direction - measuring unit

4. red blood cells – liver cells

5. straight – curved

6. Solar telescope – Hubble telescope.

(B) 1. $a_1 = \frac{V_2 - V_1}{t_1} = \frac{10 - 0}{4} = 2.5$ m/sec^2

$a_2 = \frac{V_2 - V_1}{t_2} = \frac{5 - 10}{2} = -2.5$ m/sec^2

2. $t = \frac{V_2 - V_1}{a_2} = \frac{0 - 5}{-2.5} = 2$ sec.

(C) 1. 2   2. 3   3. 1   4. 3

12 Ismailia Governorate

1

(A) 1. nucleic acid – genetic information

2. vector – scalar

3. concave – convex

(B)

Nebular theory	Modern theory
Laplace	Fred Hoyle

(C) 1. $a = \frac{V_2 - V_1}{t}$

$= \frac{25 - 0}{10} = 2.5$ m/sec^2

2. Positive acceleration.

2

(A) 1. Average speed.

2. The amount of displacement.

3. Gametes.   4. Cataract.

5. Gravity of the Sun.

(B) 1. When the observer moves in opposite direction of the object.

2. When the body moves in straight line in one direction.

(C) 1. Budding

2. (1) The nucleus divided by mitosis to two nuclei, one of then remain and the other one migrates to the bud.

(2) The bud grow into new a fungus, that seperates or remain on the mother cell forming a colony.

3

(A) 1. velocity.   2. convex lens

3. centre   4. centrosome

5. changeble

(B) 1. Position (3)   2. Position (1)

3. Position (2)

(C) 1. It reflects back on itself.

2. Genetic variation.

4

(A) 1. c   2. c   3. a   4. b   5. b

(B) – Distance = 18 + 3 + 18 + 3 = 42 m.

– Displacement = zero

(C)) 1. Metaphase, which preceded by prophase.

2. Mitosis.

13 Suez Governorate

1

(A) 1. d   2. c   3. c   4. a   5. d

(B) 1. Mitosis.   2. Metaphase.

3. The chromosomes arranged at the cell equator, where each chromosome is connected from its centromere to the spindle fibers.

(C)

Positive acceleration	Negative acceleration
When the object's speed increases by equal values through equal periods of time.	When the object's speed decreases by equal values through equal periods of time.

67

2

(A) 1. Motion.   2. Universe.

3. Relative speed.   4. Reproductive cells.

5. Average speed.

(B) 1. Because it is identified by knowing both its amount and its direction.

2. A source of genetic variation.

3. Because the angle of incidence equals the angle of reflection equals zero.

(C) 1. If the arm contains a part of the central disc.

2. If they fall parallel to each others, and parallel to the principal axis.

3

(A) 1. centrifugal force.   2. plane mirror.

3. seeds   4. mitosis

5. irregular

(B) 1. Displacement = 5 × 2 = 10 m (to the east).

2. Distance = 10 m

3. Acceleration = zero

(C) 1. It is the combination of male gamete and female gamete to form zygote.

2. It is the line connects the two centers of curvature, passing through the optical center.

4

(A) 1. pollen grains.

2. Uniform acceleration

3. solar system   4. centromere

5. double

(B)

Image properties : real, inverted and diminished.

(C) Graphs (1) , (2).

14 Port Said Governorate

1

(A) 1. b   2. d   3. c   4. d

(B) 1. It is the speed of a moving object relative to an observer.

2. It is the combination of male gamete and female gamete to form a zygote.

3. It is the ability of the organism to compensate its missing parts by mitosis.

(C) $V_1 = 80$ m/sec $V_2 = ?$ $a = -2$ m/sec^2

$t = 12$ sec

$$a = \frac{V_2 - V_1}{t}$$
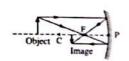
$$-2 = \frac{V_2 - 80}{12}$$

$V_2 = 56$ m/sec

2

(A) 1. Straight - curved

2. converging – diverging

3. Laplace – Fred Hoyle

4. Pollen grains – ova

(B) 1.

2.

(C) 1. Answer by yourself.

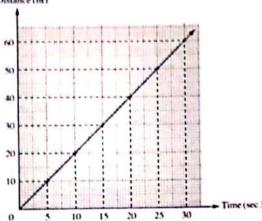2. To form two identical groups of chromosomes, each group migrates towards one of the cell's poles.

3

(A) 1. Focus   2. prophase

3. Milky Way   4. only

(B) 1. 23 chromosomes.

2. 23 pairs of chromosomes.

(C) 1. It's speed = $\frac{100}{2}$ = 50 km/h.

2. It's reflecting angle = 20°

4

(A) 1. Crossing over phenomenon.

2. The expansion of the universe.

3. Cataract.

4. Velocity.

(B) 1.

Distance (m)

2. Velocity $= \dfrac{10}{5} = 2$ m/sec.

(C) 1.

Concave mirror	Convex mirror
Object put at a distance less than the focal length.	Object put at any distance.

2.

Binary Fission	Budding
Bacteria	Yeast

15 **Fayoum Governorate**

1

(A) 1. the galaxy – 100 000 million galaxies.

2. distance – d = V × t

3. Optical centre – Focus.

4. nuclear membrane – prophase

5. straight – curved

(B) 1. It is the speed of a moving object relative to static or moving observer.

2. It is the combination of male gamete and female gamete to form a zygote.

3. It is the point of connection between two chromatids of the chromosome.

(C) $V_1 = 6$ m/sec. $V_2 = 12$ m/sec. $t = 3$ sec.

$$a = \dfrac{V_2 - V_1}{t}$$

$$= \dfrac{12 - 6}{3} = 2 \text{ m/sec}^2$$

2

(A) 1. c   2. a   3. c   4. c   5. b

(B) 1. Because the speed changes according to the road condition.

2. Because it forms virtual, erect and diminished image to the road behind the car.

3. Due to the occurance of crossing over phenomenon between the two inner chromatids of the tetrad.

(C) Distance = 15 + 30 + 15 = 60 m.

Displacement = 30 m.

Velocity $= \dfrac{d}{t} = \dfrac{30}{30} = 1$ m/sec.   (eastward)

3

(A) 1. Principal axis.   2. Acceleration

3. Nebula.   4. Irregular speed.

5. Gametes.

(B) 1. It reproduces by budding and forms a new fungus separated from the parental cell or remain connected to the parental cell forming a colony.

2. Its speed will be doubled.
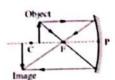
3. No gametes will be formed.

(C)

Image properties : real, inverted and magnified.

4

(A) 1. (✓)   2. (✓)

3. (✗) The pole is ...

4. (✗) ... shortest ...   5. (✓)

(B) 1. Prophase – Metaphase – Anaphase – Telophase.

2. Mitosis.

(C)

Long – shightedness	Short – shightedness
Convex lens	Concave lens

16 **Beni-Suef Governorate**

1

(A) 1. c   2. b   3. c   4. d   5. d

(B) 1. Its size contracted and its revolving speed around itself increased.

2. The amount of displacement = zero.

3. It reflects passing through the focus.

(C) 1. It is the point inside the lens on the principal axis in the mid distance between its two faces.

2. It is the combination of the male gamete and the female gamete to form a zygote.

69

2

(A) 1. Milky Way galaxy.   2. Focal length.
3. Relative speed.   4. Interphase.
5. Average speed.

(B) 1.

Hydra	Starfish
Budding	Regeneration

2.

Male gamete	Female gamete
Sperm	Ovum

3.

Virtual image	Real image
Upright	Inverted

(C) 1. $V = \dfrac{d}{t} = \dfrac{70}{5} = 14$ m/sec.

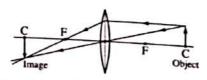2. Velocity $= \dfrac{\text{displacement}}{\text{time}}$

$= \dfrac{50}{5} = 10$ m/sec. North east direction

3

(A) 1. behind   2. telophase
3. crossing over   4. zero

(B) 1. 20 m/sec^2 2. Negative
3. 2 sec. (BC).

(C) 1. Two identical groups of chromatids are formed, each group migrates towards one of the cell's poles.

2. Chromosomes are arranged along the cell equator where each chromosome is attached with one of the spindle fibers at its centromere.

4

(A) 1. acceleration.   2. their vegetative organs.
3. Protein.   4. Fred Hoyle   5. 90

(B) 1. Because it is enough to identify its magnitude only.
2. Because it collects the rays, so the image of the near objects are formed on the retina.
3. Because asexual reproduction depends on mitosis, where the new individual gets a full copy of the parental individual's genetic traits.

(C) 1.

2. (a) 2 cm   (b) 10 cm

---

17   **Minia Governorate**

1
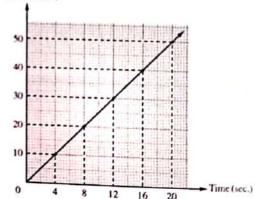
(A) 1. d   2. c   3. b   4. d   5. b

(B) 1. Interphase.   2. Befor mitosis division.
3. To prepare the cell for division process, by duplicating the genetic material.

(C) 1. It is a disease that causes a difficulty of vision as a result of the darkness of the eye lens.

2. It is the acceleration by which an object moves in a straight line when its speed changes by equal values through equal periods of time.

2

(A) 1. 40 km/h – the same
2. cooling   3. concave – convex
4. nucleic acid (DNA) – protein

(B) 1.

2. $V = \dfrac{d}{t} = \dfrac{10}{4} = 2.5$ m/sec.

(C) 1. It reflects upon itself.
2. It will form a new fungus.
3. It will form and equal image, so the driver cannot see the whole road behind the car.

3

(A) 1. Long-sightendness.
2. Velocity.   3. Light year.
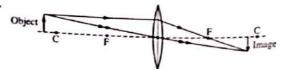4. Crossing over phenomenon.
5. Universe.

(B) 1.

Image properties : real, inverted and diminished.

(C) 1.

Sexual reproduction	Asexual reproduction
Gives an individual carries a new genetic traits.	Gives an individual carries the same genetic traits of the parent individual.

2.

Scalar physical quantity	Vector physical quantity
It is the physical quantity that has magnitude only and has no direction.	It is the physical quantity that has magnitude and direction.

4

(A) 1. speedometer

2. Pole of the mirror

3. metaphase

4. spiral

(B) $V_1 = 20$ m/sec. $V_2 = 0$ $a = -4$ m/sec^2 $t = ?$

$$t = \frac{V_2 - V_1}{a}$$

$$= \frac{0 - 20}{4} = 5 \text{ sec}$$

(C) 1. Because it is a virtual image.

2. Because the wind direction affect the velocity of the plane, and so the amount of fuel consumed.

(D) Answer by yourself.

18 Assiut Governorate

1
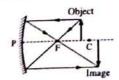
(A) 1. c   2. b   3. c   4. a   5. c   6. a

(B)

Sexual reproduction	Asexual reproduction
The new individual with traits differ from their parents.	The new individual with traits identical to those of the parent.

(C) 1.

2. Image properties : real, inverted and magnified.

2

(A) 1. The pole of the mirror.   2. spiral

3. long-sightedness.   4. prophase

5. zero

(B) 1. It will reflected by angle = 60° from the plane mirror.

2. Its size decrease, and its revolving around itself increase.

(C) 1. Mitosis.   2. Metaphase.

3. The chromosomes which are connected with the spindle fibers are arranged at the cell equator.

3

(A) 1. Meiosis.   2. Average speed.

3. The principal axis.

4. Milky Way galaxy.   5. Interphase.

(B) 1. The distance between the focus and the pole of the mirror equals 7 cm.

2. The speed of the object is changed by 10 m/sec. each one second.

(C) 1. Both bodies are moving with a regular speed.

2. The body (A) is faster than the body (B), because it cover the same distance (6 m) in a shorter period of time (3 sec.).

3. $V = \frac{d}{t} = \frac{6}{3} = 2$ m/sec.

4

(A) 1. (✗) ... Chamberlain and Moulton.

2. (✓)   3. (✗) ... mass.

4. (✗) ... virtual.   5. (✓)

(B) 1. Because the refracted light rays are parallel and never intersect.

2. Due to the continous separation between galaxies in the space as a result of their regular movement.

(C) Answer by yourself.

19 Sohag Governorate

1

(A) 1. distance – time

2. scalar – magnitude

3. equal – perpendicular

4. universe – solar system.

5. binary fission – simple algae.

(B) 1. $a = \frac{V_2 - V_1}{t}$

$$= \frac{25 - 0}{10} = 2.5 \text{ m/sec}^2$$

2. Positive acceleration.

(C) 1. It occurs in most higher living organisms through two living organisms, one of them is male and the other is female.

2. The point of collection of to refracted light rays.

3. A cell that produced due to fertilization, and it contains the complete number of chromosomes of the living organism.

2

(A) 1. First law of light reflection.

2. Nucleus.

3. Vegetative reproduction.

4. Milky Way galaxy.   5. Distance.

(B) 1. Due to the condition of the road and traffic.

2. Because the male gamete (N) combines with the female gamete (N) to produce a zygote (2 N).

3. Because lens has two spherical surfaces, and mirror has one spherical surface.

(C) 1. Velocity $= \dfrac{\text{total distance}}{\text{total time}} = \dfrac{80}{80} = 1$ m/sec.

2. $\overline{V} = \dfrac{\text{total distance}}{\text{total time}} = \dfrac{40 + 80 + 40}{35 + 20 + 25} = \dfrac{160}{80}$

$= 2$ m/sec.

3
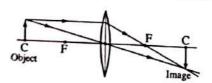
(A) 1. prophase 1.   2. Regular speed

3. nuclear.   4. 10 m/sec.

(B) 1.

2. Image properties : real, inverted and equal to the object.

(C) 1. The spindle fibers not formed, there for the cell division doesn't completed.

2. Its displacement = zero.

3. It reflects back on itself.

4

(A) 1. b   2. b   3. b   4. d

(B) 1.

Long - sightedness	Short - sightedness
The image formed behind the retina.	The image formed in front of the retina.

2.

Mitosis division	Meiosis division
produces 2 cells.	produces 4 cells.

3.

Crossing star theory	Modern theory
Chamberlain and Moulton.	Fred Hoyle.

(C) 1. Mitosis   2. Metaphase.

3. Growth of the living organisms and compensation of the damaged cells.

20   **Qena Governorate**

1

(A) 1. a   2. c   3. d   4. b   5. a   6. d

(B) 1. It is the point in the middle of its reflecting surface.

2. It is the combination between male gamete (N) and female gamete (N) to produce a zygote (2 N).

(C) $V_1 = 50$ m/sec $V_2 = ?$ $a = -2$ m/sec^2 $t = 12$ sec

$$a = \frac{V_2 - V_1}{t}$$

$$-2 = \frac{V_2 - 50}{12}$$

$$-24 = V_2 - 50$$

$$V_2 = 26 \text{ m/sec.}$$

2

(A) 1. Crossing star.   2. distance.

3. nucleic acid (DNA) – protein
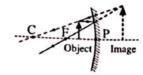
4. 12000 million   5. outer

6. scalar

(B) 1. The total distance covered during one hour equals 60 km.

2. The angle between the reflected light ray and the normal equals 40°.

(C) 1. Metaphase.

2. The chromosomes which are connected with the spindle fibers are arranged at the cell equator.

3

(A) 1. (✓)   2. (✗)   3. (✓)

4. (✓)   5. (✗)   6. (✗)

(B) 1.

2. Image properties ; virtual, erect and magnified.

(C) 1. Forming spindle fibers during cell division.

2. They produce the galaxies, stars and universe through millions of years.

4

(A) 1. Relative speed.   2. Nebula.

3. principal axis.   4. Regeneration.

5. Gravity.   6. Velocity.

(B) 1.

Uniform speed	Non - uniform speed
It is the speed by which the object moves when it covers equal distances at equal periods time.	It is the speed by which the object moves when it covers unequal distances at equal periods of time.

2.

Thick convex lens	Thin convex lens
It has a small focal length.	It has a large focal length.

(C) 1. Due to the occurance of crossing over phenomenon during the formation of gametes, and also the offspring resulted gets his genetic traits from two sources (the male and the female).

2. Because it diverges the rays coming from far objects before falling on the eye, so the image is formed exactly on the retina.

21   Luxor Governorate

1

(A) 1. regular   2. larger than

3. regeneration.   4. the Sun.

5. tumor.

(B) 1. Its speed decreases to quarter.

2. The variation of genetic traits don't occur among the individuals of the same species.

3. Passes without refraction.

(C) - Tht image at a distance greater than 15 cm

- Image properties : real, inverted and magnified.

2

(A) 1. a   2. b   3. c   4. b   5. d

(B) $t_1 = \dfrac{d_1}{v_1} = \dfrac{30}{3} = 10$ sec.

$t_2 = \dfrac{d_2}{v_2} = \dfrac{120}{6} = 20$ sec.

$V = \dfrac{d_1 + d_2}{t_1 + t_2} = \dfrac{30 + 120}{10 + 20} = 5$ m/sec.

(C) 1. Because it produces new individuals identical in genetic structure to the parental individual by mitotic division.

2. Because distance is directly proportional with time when the object moves with a constant speed.

3

(A) 1. Motion.   2. Real focus.

3. Sporangia.

4. Star explosion phenomenon.

5. Fertilization.

(B) 1. At the focus.

2. Because the refracted light rays from the lens are parallel and don't intersect.

(C) 1. Mitosis in stem cell and meiosis in ovary cell.

2. Sexual reproduction.

3. In stem cell : 8 pairs.

In ovary cell : 4 pairs.

4

(A) 1. Concave mirror   2. Big Bang theory.

3. reproductive cells.   4. equal to

5. speedometer.

(B) 1. Displacement $= 8 + \left(\frac{1}{2} \text{ circumference}\right) + 7$

$= 8 + \left(\frac{1}{2} \times 2 \times \frac{22}{7} \times 7\right) + 7 = 37$ m

2. Displacement $= 8 + 7 = 15$ m (east direction).

Velocity $= \dfrac{\text{displacement}}{\text{time}} = \dfrac{15}{5} = 3$ m/sec.

(east direction)

(C) 1.

Reproductive cell	Gamete
Meiosis division	Doesn't divide

2. Answer by yourself.

22   Aswan Governorate

1

(A) 1. convex   2. zero.

3. nebular.   4. centrosome.

(B) 1. Budding.

2. Reproduction by regeneration.

(C) $V_1 = 80$ m/sec $a = -2$ m/sec^2 $t = 12$ sec $V_2 = ?$

$$a = \frac{V_2 - V_1}{t}$$

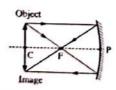$$-2 = \frac{V_2 - 80}{12}$$

$V_2 = 56$ m/sec

[2]

(A) 1. d   2. b   3. c   4. a

(B) 1. Because the relative speed equals the difference between the two speeds equals zero.

2. Because the refracted light rays are parallel and don't intersect.

(C) 1. Carries the genetic information of the living organism.

2. Measures the speed of the car directly.

[3]

(A) 1. Displacement.

2. Vegetative reproduction.

3. Big Bang theory.

4. Zygote.

(B) 1. It passes without refraction.

2. Its speed decreases to half.

(C)

Object
C F P
Image

[4]

(A) 1. virtual.   2. scalar

3. Sun   4. metaphase

(B) 1. If the object moves with a regular speed.

2. If the incident light ray falls perpendicular to the plane mirror.

(C) 1. Crossing over phenomenon.

2. Prophase 1   3. Meiosis.

4. It works on the variation of genetic traits amoung the members of the same species.

74

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(23) Red Sea Governorate

[1]

(A) 1. Centromere.   2. Velocity.

3. Light year.   4. Regeneration.

5. Secondary axis.

(B) 1. An equal image will be formed, and the driver cannot see the whole street behind the car.

2. Its acceleration equal zero.

3. Expansion of the universe.

(C) $V_1 = 130$ m/sec $a = -5$m / sec^2 $V_2 = ?$ $t = 20$ sec

$$a = \frac{V_2 - V_1}{t}$$

$$-5 = \frac{V_2 - 130}{20}$$

$V_2 = 30$ m/sec.

[2]

(A) 1. Meiotic – reproductive

2. pole – center of curvature

3. hydrogen – helium.

4. 25 – 5

(B) 1. observer   2. budding

3. nebular   4. The optical center
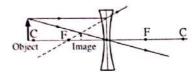
(C) 1. 44   2. 44   3. 22

[3]

(A) 1. To prepare the cell for division, by occurance of some biological processes, and duplicating the amount of the genetic material (DNA).

2. Answer by yourself.

3. Due to nuclear reaction.

4. Answer by yourself.

(B) 1. It is the combination of male gamete (N) and female gamete (N) to form a zygote (2N).

2. It is the exchange of some parts of the genetic materials between the two inner chromatides of the tetrad.

3. Its focal length equals 20 cm.

(C) 1. 44 chromosomes.   2. 44 chromosomes.

3. 22 chromosomes.

[4]

(A) 1. c   2. d   3. a   4. b   5. a   6. c

(B) - Asexual reproduction gives individuals identical to the parent individual, because it depends on mitosis.

- Sexual reproduction gives individuals combine genetic traits of both male and female individuals, because it depends on meiosis.

(C) 1. Concave lens.

2.

Object   Image

24 North Sinai Governorate

1

(A) 1. the center of curvature – the pole.

2. gametes formation – Fertilization.

3. hydrogen – helium.

4. vector – scalar

(B) 1. Because it moves in straight line or curved line or combination of both.

2. Because it occurs to reproductive cells (2N) and produces gametes (N).

(C) 1. At its Focus.

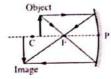2. Because the refracted rays of the lens are parallel and don't intersect.

2

(A) 1. c   2. c   3. c   4. b   5. b   6. a

(B) 1, 2. Answer by yourself

3

(A) 1. zero.   2. at constant speed.

3. prophase.   4. velocity

5. Milky Way

(B) 1. metaphase – mitosis

2. Because the chromosomes which are connected with the spindle fibers are arranged at the cell equator.

3. Anaphase.

(C)

- Image properties : real, inverted and magnified.

4

(A) 1. Average speed.   2. Nebula.

3. Regeneration.   4. Virtual image.

(B) 1. Short-sightedness.

2. The cell can not divided.

(C) 1. Total distance = 10 + 10 = 20 m.

2. Velocity $= \dfrac{10}{5} = 2$ m/sec.

25 South Sinai Governorate

1

(A) 1. Centromere.   2. optical center.

3. Solar system.   4. Regeneration.

5. Velocity.

(B) 1. Figure (2).

2. Figure (1) is mitosis.

Figure (2) is meiosis.

(C) $t = \dfrac{d}{v} = \dfrac{200}{40} = 5$ hours

Time of arival = 6 + 5 = 11 am

2

(A) 1. Because it depends on mitosis division.

2. Due to the condition of the road and the traffic.

3. Because mass is fully defined by knowing its magnitude only, while force it is identified by knowing its magnitude and direction.
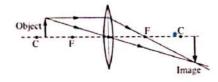
(B) Axis (1) is time axis.

Axis (2) is speed axis.

(C) 1. equal to   2. zygote

3. inverted   4. light reflection

3

(A) 1. c   2. d   3. d   4. d   5. b

(B) 1. This star attracted the Sun to it, leading to a great expansion in the part of the Sun facing it.

2. Short-sightedness.

(C)

- Image properties : real, inverted and magnified.

4

(A) 1. (✗)   2. (✗)   3. (✓)   4. (✗)   5. (✗)

(B) 1. $a = \dfrac{V_2 - V_1}{t}$

$\dfrac{10}{t} = \dfrac{V_2 - zero}{t}$

$V_2 = 10$ m/sec.

2. positive acceleration.

(C) 1. Detect the speed directly.

2. Carries the genetic traits of the individuals.

26 The New Valley Governorate

1

(A) 1. c   2. b   3. b   4. c

(B) 1. kg

2. m/sec in a certain direction.

(C) 1. Real, inverted and equal to the object.

2. Distance = 12 + 12 + 12 + 12 = 48 cm

2

(A) 1. long-sightedness – convex lens.

2. distance – time.

3. centrosome – cytoplasm.

4. two chromatids – centromere.

(B) 1. 2. Answer by yourself.

(C) a. Mitosis.

b. No, because each one of the produced cell has a complete number of chromosomes of the parent cell.

3

(A) 1. Relative speed.   2. Distance.

3. Interphase.   4. Real focus.

(B) 1. It measures the speed directly.

2. It carries the genetic traits of the individual.

(C) 1. (a) $a = \dfrac{V_2 - V_1}{t} = \dfrac{10 - zero}{4} = 2.5$ m/sec²

(b) $a = \dfrac{V_2 - V_1}{t} = \dfrac{5 - 10}{2} = -2.5$ m/sec²

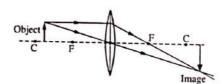2. $t = \dfrac{V_2 - V_1}{a} = \dfrac{zero - 5}{-2.5} = 2$ sec.

4

(A) 1. eye cornea   2. nuclear

3. bread mould fungus.   4. double.

(B) 1. Because they need mitosis, which is important for growth and replace the damaged cells.

2. Because the convex lens is a collecting lens, while the concave lens seperats the light rays fall on it.

3. Because the relative speed equals the difference between the two speeds equals zero.

(C) Answer by yourself.

27 Matrouh Governorate

1

(A) 1. b   2. c   3. c   4. c   5. b

(B)

- Image properties : real, inverted and magnified.

(C) 1. It is a type of asexual reproduction that takes place in plants' vegetative organs without the need of seeds

2. It is the straight line that passes by the pole of the mirror (p) and its center of curvature (c).

2

(A) 1. Meiosis.   2. Galaxy.

3. Relative speed.   4. Optical center.

5. Motion.   6. Long-sightedness.

(B) 1. $V = \dfrac{50 + 100 + 50}{30 + 60 + 10} = 2$m/sec.

2. Velocity $= \dfrac{100}{100} = 1$ m/sec. (east direction).

(C) 1.

Budding	Regeneration
Yeast	Starfish

2.

Real image	virtual image
can be received on a screen.	can not be received on a screen.

3

(A) 1. sporogony.

2. cytoplasm condensation.

3. no image.

4. 4 m/sec^2

5. displacement.

(B) The rearrangement is : 4 ⟶ 2 ⟶ 1 ⟶ 3

(C) 1. It reflects on itself.

2. The planets will move freely in the space.

3. The body moves with positive acceleration.

4

(A) 1. Because they have magnitude and direction.

2. Because the lens has two spherical surfaces, but the mirror has one spherical surface.

3. Because it depends on meiotic division, and due to the occurance of crossing over phenomenon.

4. Because the relative speed equals the difference between the two speeds equals zero.

(B) 1. Metaphase – Mitosis.

2. The chromosomes which are connected with the spindle fibers are arranged at the cell equator.

(C) 1. 10

2. hydrogen and helium.
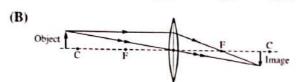
3. four

4. Distance

① Cairo Governorate

1

(A) 1. Vector – scalar   2. spiral

3. mitosis – meiosis

(B) 1. It is the point inside the lens lies on the principal axis in the mid distance between its two faces.

2. It is the speed of an object when covers equal distances at unequal periods of time, or covers unequal distances at equal periods of time.

3. It is the combination between male gamete and female gamete to form zygote.

(C) Acceleration (a) $= \dfrac{V_2 - V_1}{\Delta t} = \dfrac{12 - zero}{4} = 3$ m/sec²

The type of acceleration is positive acceleration.

2

(A) 1. c   2. b   3. d   4. d   5. b

(B)

The properties of the formed image :
– real, inverted and diminished.

(C) 1. Due to elongation of the eyeball, or the surface of the eye lens is more convex.

2. Because asexual reproduction depends on mitotic division, where the new offspring gets a full copy of the parental individual's genetic traits.

3

(A) 1. protein   2. 10

3. prophase 1   4. Fred Hoyle

5. same   6. diverges

(B) 1. The starfish arm could be reproduce by regeneration and give out a complete animal.

2. It will reflect passing through the focus.

(C) 1. Kilogram or gram

2. m/sec. or km/h. (in a certain direction)

4

(A) 1. Average speed. 2. Uniform acceleration.

3. Universe.   4. Reproduction.

5. Speed.   6. Angle of incidence.

(B) 1.

Distance	Displacement
The actual length of the path that a moving object takes from the start point of movement to the end point.	The length of the shortest straight line between two positions.

2.

Real image	Virtual image
It is the image which can be received on a screen.	It is the image which cannot be received on a screen.

② Giza Governorate

1

(A) 1. centre.   2. amoeba.

3. parallel to the principal axis.

4. scalar.

(B) 1. Because its regular speed doesn't change as time passes (ΔV = zero).

2. To form two identical groups of chromosomes at each pole of the cell.

(C) Pollen grain : Formed in plant anthers.

Sperm : Formed in human testes.

2

(A) 1. c   2. b   3. d   4. b

(B) 1. When the object placed at the centre of curvature of the concave mirror.

2. When the object moved in a straight line at certain direction.

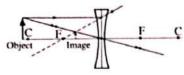**(C)** Actual speed = relative speed – observer's speed.

= 80 – 30

= 50 km/h

3

(A) 1. Nebular theory.   2. DNA.

3. Convex mirror.   4. Velocity.

(B) 1. The arrangement of homologous pairs of chromosomes, where each pair consists of 4 chromatids.

2. It is the distance between the principal focus and the optical centre of the lens.

(C) 1.

Object   Image   C   F   F   C

2. The properties of the formed image :
virtual, erect and diminished.

4

(A) 1. nuclear.   **2.** bread mould fungus.

      3. convex lens   **4.** 80

(B) 1. The speed of the car $= \dfrac{100}{2} = 50$ km/h

      2. It is the cell produced from fertilization and it contains the complete number of chromosomes of the living organism.

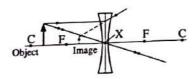**(C)** Time (t) $= \dfrac{V_2 - V_1}{a} = \dfrac{zero - 30}{-3} = 10$ sec.

3   Alex. Governorate

1

(A) 1. Milky Way

      2. mass – acceleration.

      3. spindle fibers

      4. inner chromatids of the tetrad

(B) 1.

C   F   X   F   C
Object   Image

      2. The optical centre

(C) 1. Fusion of male gamete and female gamete to form the zygote.

      2. It is the radius of the sphere that the mirror is a part of it.

2

(A) 1. d   **2.** b   **3.** b   **4.** a

(B) 1. They are collected at the focus (real focus).

      2. The pollen grains will produced inside the anther, the ovules will produced inside the ovary.

(C) 1. Anaphase.   **2.** Prophase.

3

(A) 1. Galaxy.   **2.** Regeneration.

(B) 1. Fourth - 40

      2. Acceleration (a) $= \dfrac{V_2 - V_1}{t} = \dfrac{40 - 0}{4} = 10$ m/sec^2

(C)

P.O.C	Long-sightedness	Short-sightedness
Concept :	Seeing the far objects clearly but the close objects are not seen clearly.	Seeing the close objects clearly but the far objects are not seen clearly.
Treatment :	By using convex lens.	Busing concave lens.

4

(A) 1. binary fission

      2. at a distance smaller than the focal length.

(B) 1. To release the spores and fall on suitable environment to start growing and produce new organism.

      2. Due to the formation of hydrogen and helium gasses.

(C) 1. Figure (1).

      2. The distance between the object and the mirror is not equal the distance between the image and the mirror - the image is inverted not upright.

4   Kalyoubia Governorate

1

(A) 1. Centromere.

      2. Secondary axis of the lens.

      3. Radius of curvature of the mirror.

      4. Solar system.

      5. Irregular speed.

(B) 1. The value of displacement $= 5$ m

      2. The speed of moving object with respect to stationary or moving observer.

      3. Net of fibers extends between the two poles of the animal cell.

(C) 1. The displacement $= 40 - 10 = 30$ m. To the south.

      2. $V_{(ab)} = \dfrac{10}{2} = 5$ m/sec.

        $V_{(bc)} = \dfrac{30}{10} = 3$ m/sec.

        $V_{(cd)} = \dfrac{40}{8} = 5$ m/sec.
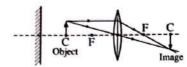
        $V_{(de)} = \dfrac{30}{5} = 6$ m/sec.

      $\therefore$ The person moves with the least possible speed in the part (bc).

2

(A) 1. b   2. d   3. a   4. a   5. d

(B) 1.

2. The distance between the two images
= 12 + 12 + 8 + 8 = 40 cm.

(C) 1. Mitosis.   2. Metaphase.

    3. – The growth of living organism.

       – The compensation of the damaged cells.

3

(A) 1. (✗)   2. (✓)   3. (✗)   4. (✗)   5. (✗)

(B) 1. Because it reduces the number of chromosomes to the half in each one of the produced cells (gametes).

    2. Because liver cells divide by mitosis to compensate the damaged part.

(C) 1. $\text{Velocity} = \dfrac{\text{displacement}}{\text{time}} = \dfrac{\text{zero}}{1} = \text{zero}$

    2. $\text{Average speed} = \dfrac{\text{total distance}}{\text{total time}}$

$$= \dfrac{80}{1} = 80 \text{ km/h.}$$

4

(A) 1. Pollen grain do not formed and the sexual reproduction does not take place.

    2. The speed of the moving object decreased to the half.

    3. The shape of galaxy is changed.

    4. The gold molecules absorb light energy and change it to heat leading to burn and kill the cancer cells.

    5. The ray reflects on itself.

(B) 1. Virtual, erect and diminished image always formed.

    2. Virtual, erect and magnified image is formed at the same side of the object.

    3. No image is formed.

(C) 1. $(a)_1 = \dfrac{V_2 - V_1}{t} = \dfrac{10 - 0}{4} = 2.5 \text{ m/sec}^2$

     $(a)_2 = \dfrac{V_2 - V_1}{t} = \dfrac{5 - 10}{2} = -2.5 \text{ m/sec}^2$

    2. $t = \dfrac{V_2 - V_1}{a} = \dfrac{0 - 5}{-2.5} = 2 \text{ sec.}$